Factory

MANAGEMENT AND MAINTENANCE

Vol. 94, No. 6 — JUNE, 1936

CONTENTS

No Trespassing 205
An editorial

Let's Tell the Employees 206
Kelvinator a convert to current personnel practice

The Schoolhouse by the Mill 208
Forestalls possible shortages of skilled labor

Time Study and Economic Balance 209
Scientific approach to old, old problem

For the Sake of the Product 211
Air conditioning

Five Times Safer Than in '29 212
No reason why any plant cannot equal Murray's record

Standard Costs for Profit Control 215
A goal toward which progress may be chalked up

If the Worker Only Knew— 217
Wouldn't he be strong for employee representation?

Tumbler Torture 218
Proving ground methods applied to fragile glassware

Penetrating the Skin of Industry 219
Occupation dermatitis is no respecter of persons

For Every Job, a Rating 221
An incentive plan that makes for lower unit costs

Thinking of Burning Oil? 224
It's all a matter of price

So Your Walls Leak! 225
They needn't. Here are the things to do

New Instruments for Industry 227
Make new measurements part of the day's work

Mechanical Power Drives 229
Data Sheets

You Want to Know 231

Operating Shorts

Locating Grounds on a D.C. System 232
Employees Get Bonus for Length of Service 232
Simple Device that Stopped Eye-Strain 232
Company Name on Foreman's Shop Coats 232
Undersize Spacers Caused Busbar Distortion 233
Radiators Go Round and Come Out Here 233
Tell-Tale Gives Light for Replacing Fuses 233
Improper Ventilation Caused Generator Trouble 233
Rubber Grip Absorbs Air Tool Vibration 234
It Wasn't Overloaded, but It Stopped 234
Folding Memo Desk Saves Aisle Space 235
Plates on Machines Made Men More Careful 235

Flashes from the Equipment Makers 236

What's New in Equipment 237

Trade Literature 240

Questions and Answers ..... **Advertising Page 32**

Books ..... **Advertising Page 46**

FACTORY'S PLANT OPERATION LIBRARY

Materials Handling **S261-S276**

MASON BRITTON, *Senior Vice-President* — L. C. MORROW, *Editor* — A. M. STAEHLE, *Manager*

G. A. VAN BRUNT, LEWIS K. URQUHART, *Associate Editors* — C. G. SMITH, J. F. ANDREWS, *Assistant Editors*

A. H. MOGENSEN, ARTHUR VAN VLISSINGEN, JR., *Consulting Editors*

H. P. DUTTON, *Chicago* — LEONARD CHURCH, *Cleveland* — CHARLES B. GORDY, *Detroit* — PAUL WOOTON, *Washington*

Factory Management and Maintenance is a consolidation of *Factory and Industrial Management* (including *"Factory"*) and *Maintenance Engineering*

Price 35c. a copy. Subscription rates—United States, Canada, Mexico and Central and South American countries, $3 a year. All other countries, $4 a year or 16 shillings. Cable address "McGrawhill, New York." Member of A.B.P. Member of A.B.C. Copyright, 1936, by McGraw-Hill Publishing Co., Inc., 330 West 42d Street, New York, N. Y.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

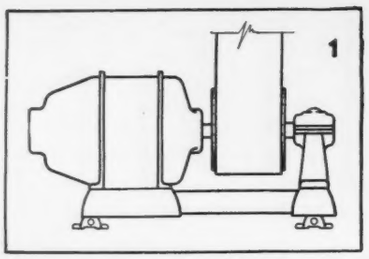
JAMES H. MCGRAW, JR. Chairman — MALCOLM MUIR President — JAMES H. MCGRAW Honorary Chairman

MASON BRITTON Senior Vice-President — B. R. PUTNAM Treasurer — D. C. MCGRAW Secretary

Factory Management and Maintenance. June, 1936. Vol. 94, No. 6. Published monthly. McGraw Hill Publishing Company, Inc., 330 West 42d Street, New York. Entered as second-class matter March 17, 1933, at Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A.

...for the RIGHT answer to any speed reduction problem.....

LINK-BELT POSITIVE DRIVES



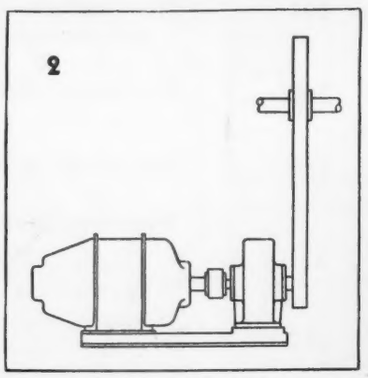
150 Horse Power—570 R.P.M. Motor
Flat belt drive
Outboard bearing
Slide Rails
Driven shaft operates at 70 R.P.M.

Sketches No. 1 and No. 2. An example indicating one of many relative advantages of the Link-Belt Herringbone Gear Speed Reducer.

Assuming a drive is required to transmit 150 horse power from an electric motor to a shaft operating at 70 R.P.M. If a flat belt or V-belt drive is used (Sketch 1), a 570 R.P.M. motor would be necessary.

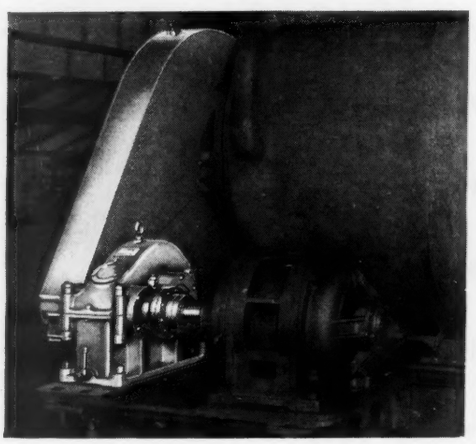
Using the combination of a single reduction Herringbone Reducer and a Roller Chain Drive (Sketch 2), permits the selection of an 1150 R.P.M. motor, with the following advantages:

1. Compactness.
2. Ease of installation.
3. Greater flexibility in arrangement and location of motor.
4. More efficient, smaller and less costly motor.
5. Lower installation cost.
6. Provision for increasing or decreasing speed of driven shaft by changing ratio in sprocket wheels.
7. Total cost of installation is less than for drive using flat belt or V-belt.



150 Horse Power—1150 R.P.M. Motor
Flexible Coupling
Size S-14 Single Reduction Link-Belt Herringbone Gear Reducer
Link-Belt "RC" Class Roller Chain Drive
Driven shaft operates at 70 R.P.M.

Below: Illustration of an actual Link-Belt Positive Drive installation. A 20 H. P. motor, transmitting power to Link-Belt herringbone gear reducer and an encased Link-Belt Silverlink roller chain drive. A typical example of a Link-Belt reducer installation.



Because Link-Belt makes all three types of speed reducers—the Herringbone Gear Type—the Worm Gear Type—the Motorized Helical Gear Type—our recommendations are wholly unbiased in determining the correct reducer for each application.

Catalogs on any or all Link-Belt reducers sent on request. For the complete Link-Belt line of Positive Drives ask for Binder 2100. Address Link-Belt Company, Indianapolis, Chicago, Philadelphia, Atlanta, San Francisco, Toronto, or any of our offices in principal cities.

LINK-BELT *positive* DRIVES INCLUDE

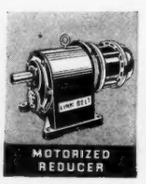
SILENT CHAIN DRIVE

ROLLER CHAIN DRIVE

P.I.V. GEAR SPEED VARIATOR

V.R.D. VARIABLE ROLLER DRIVE

HERRINGBONE GEAR REDUCER


MOTORIZED REDUCER

WORM GEAR REDUCER

5736

Factory
MANAGEMENT AND MAINTENANCE

L. C. MORROW
Editor

No Trespassing

ANOTHER foray of the federal government into the field of industry control was successfully repulsed last month. The defeat was administered by the United States Supreme Court in its decision declaring the Guffey Coal Act unconstitutional.

Admittedly conditions in the bituminous coal industry were bad. Admittedly the industry needed to do something about them. The fact remains that the Guffey Act established a little NRA in the coal industry—obviously would have been followed, if sustained by the Supreme Court, by other little NRA's.

Enough little NRA's would, in the aggregate, restore the old NRA which was declared unconstitutional, and which was first cousin, if not blood brother, to federal control of industry.

It is apparent that if the Guffey Act had been sustained, such action would have constituted a long step toward eradicating boundaries between interstate and intrastate commerce. It would also have upheld the National Labor Relations Act, which it now seems must likewise be considered unconstitutional.

There is a way out for the coal industry. It is the same way out for all industry, and it conforms to economic law. The magazine *Coal Age* defines it:

"Unless coal prices are on a fair competitive basis, coal will continue to lose business to its rivals, and opportunities for employment in mining will be further and permanently curtailed. Lower production costs are imperative if coal is to maintain or improve its position. That is an inescapable fact.

"Costs may be reduced without the machine by the simple expedient of depressing wage levels so far that the advantage oil and gas now have in direct labor charges may be wiped out. Or management may lean more heavily on the machine and so reduce costs while making a higher wage scale supportable. Admittedly that may involve some temporary displacement of workers but lower costs will open the door to recovery of some of the previous losses to competitive fuels, check further encroachments, and thereby ultimately increase the opportunities for additional mine employment."

THERE is only one conclusion to reach: The extent to which any industry can prosper depends upon its ability to produce at costs that will permit competitive distribution.

Let's Tell the

STARTED largely as a medium for social chitchat among Kelvinator employees, COLD CRAFT, the company magazine, has gradually included more and more articles that inform shop workers of the status of manufacturing plans and of the position of the company in the industry. The magazine is distributed not only to people currently employed in the plant, but to all who are temporarily laid off or who were on the payroll during the past year. This period of the year is preparation time for new models, and workers are anxious to know when production will begin. In last October's issue, for example, the workers were informed that:

Due to changes in plant layout we shall not be able to get into full production until at least the first of November. In the meantime, however, scattered operations will be started. The Press Shop, for instance, will start on press parts as soon as the dies are completed and the new welding equipment and transformers are set up—which should be around the 21st of October. . . The Porcelain Department will start as soon as these parts are fabricated by the Press Department. The lacquer cabinet assembly, however, will not be started until the new shell welders and transformers are installed and the synthetic plant layout is completed. . .

Competition Must Be Met

In the past few months much attention has been devoted to regularization of employment through building up banks of parts and completed products within the manufacturing system, as exemplified by the statement of General Motors that $60,000,000 would be so invested in that corporation during the current year. Refrigerator sales are quite as abrupt and uneven as automobile sales. March, April, and May represent the peak for the year in shipments. Because of an established policy of building ahead and storing, however, Kelvinator's lowest production from December, 1934, to June, 1935, occurred in April, the highest shipment month.

These characteristics of the industry and Kelvinator's efforts to regularize employment were set forth in the same October issue:

New models, necessary to keep Kelvinator in the forefront of the refrigerator industry, mean new designs, new plants, and new plant layouts. . .

These changes, with their accompanying delays and upsets in our production routine, are expensive, and are no more to the liking of the company officials than to the man in the shop. But competition must be met if we are to exist at all, and advanced ideas must be given to the public, and if we can, by our combined cooperation, meet this competition and interest the public, we are off to a successful year.

Contrary to opinions quite prevalent, the heaviest selling months are not normally our heaviest production months. We must build ahead of the dealer so that we can stock his salesroom prior to warm weather with the variety and quantity of models he is most likely to sell . . . and we must keep on hand a full stock from which to ship him emergency orders.

Steadier Employment

The article continued by stating that capacity exists to manufacture strictly according to seasonal orders without storing ahead, but—

To do this would create a distinct hardship to our employees; it would occupy a greatly increased number of

Employees

Workers have a right to know plenty that isn't usually told them — why the plant is busy this month, flat the next — when they may expect to come back to work — when a layoff is inevitable. Kelvinator uses Cold Craft, the employees' own magazine, to keep them informed on these points and a lot of others that hit them where they live

★

G. V. POLLARD
General Works Manager
Kelvinator Corporation, Detroit

men and women for a few weeks and then a complete layoff for the major portion of the year. . . It would mean that in addition to our regular employees, many of whom have been with us for years, we would call in hundreds of new people to help over the high production period—and when the schedules had been completed all would be sent home, the regulars as well as newcomers. Instead of that, your company's policy has been to average this production over as long a period as possible and to set the schedules on the basis of monthly sales, leveling off the variations in months and periods by building and storing sufficient quantities of each model to care for the succeeding months' shipments and to provide a "bank" for unusual demands.

Last year this plan resulted in the storage of up to some 60,000 units at one time and kept our regular employees busy right up until inventory time as against the plan of reaching the height of intensive production during the middle of February or March and then dropping off sharply to the zero line in May and June just because the majority of dealer shipments had been made prior to these months.

The results of the policy were included in the following table for the information of the employees:

Month	*Built* %	*Shipped* %	*Stored** %
Oct. (1934) .	.033	.013	.1123
Nov.	.050	.033	.1590
Dec.	.110	.107	.1666
Jan. (1935) .	.100	.066	.2417
Feb.	.110	.075	.2916
March	.120	.130	.2500
April	.100	.166	.2083
May	.110	.150	.1750
June	.120	.100	.1417
July	.080	.090	.1500
Aug.	.064	.050	.1666
Sept. **	.003	.020	.1417

*At end of month compared with year's schedule
**Inventory

In contrast to the even production figures, note the wide variation in shipments and imagine working hours based upon such standards alone. Note how slight is the variation in production percentage for eight months. If we could only control the buying public so as to average their purchases over the entire year, instead of piling them up around the holidays and in hot weather, these figures would be still more evenly distributed.

While there exists a feeling generally in the plant paper field that articles on "economics" are dangerous stamping ground, yet these excerpts from COLD CRAFT convey valuable information to Kelvinator employees and are much more valuable practical lessons in economics as applied to their daily occupation than could possibly be gleaned from economics texts or found in releases to the daily press by pressure groups interested in furthering this or that method of getting us out of the depression. A management with such a constructive achievement need have no fear that it is treading dangerous paths; it is giving its workers information which should be theirs by right of identity with the institution.

In the December issue of COLD CRAFT, additional mention was made of the schedule situation:

. . . but to please the public means more than doing our job well in the shop. We must first have a product designed for us to build, and once designed and built we must interest the public in the product sufficiently to have them buy it in preference to numerous other similar products. It is imperative that all this be done at

(Continued on advertising page 34)

The Schoolhouse by the Mill

HUGH W. WRIGHT
The American Rolling Mill Company
Middletown, Ohio

SUPPOSE you were the manager of a division manufacturing a relatively new product for which there was a steadily growing demand, and were faced with a shortage of skilled labor, what would you do? To complicate the situation, suppose your company had a long-established policy of promoting from within the organization.

The chances are—if you honestly wanted to carry out that policy—you would provide some sort of vocational training which would enable you to promote certain of your men to better jobs and start newcomers at the bottom. That is exactly how the management of this company's pipe manufacturing division solved the problem. That is why they built the schoolhouse by the mill.

To Make Better Welders

However, don't be misled by that term "schoolhouse." Our manager and superintendent are practical men. Their main objective in organizing this school was to make better welders and better steel fabricators who could turn out a larger quantity of spiral welded pipe and other products.

To accomplish this to the fullest extent they realized they must not only provide vocational training, but also supply training that would give the men a clearer view of the intangible economic factors surrounding their jobs. They knew, from their own experience, that each man so trained would tackle his job with greater understanding, interest, and enthusiasm, and would derive more pleasure and more satisfaction in doing it. They were not mistaken.

A young foreman who had had a wide variety of practical experience was assigned to act as full-time instructor. The superintendent acts as "principal." The original class consisted of 35 men selected from various sections of the division. Other men began immediately to ask "Why can't we get in?" As soon as possible another group was started. Most men of the department are now in training.

The first schoolroom was in a section of the factory building. It was noisy and drafty, hardly suited to the purpose. Then a newly organized company that manufactures steel buildings came to us for advice and cooperation. The task of fabricating their building units was assigned to our fabricating division. Our manager proposed that they design a building to serve as a rural or portable schoolhouse. This they did, and he erected one of the first buildings of this type on a plot adjacent to the mill.

Three Hours in School

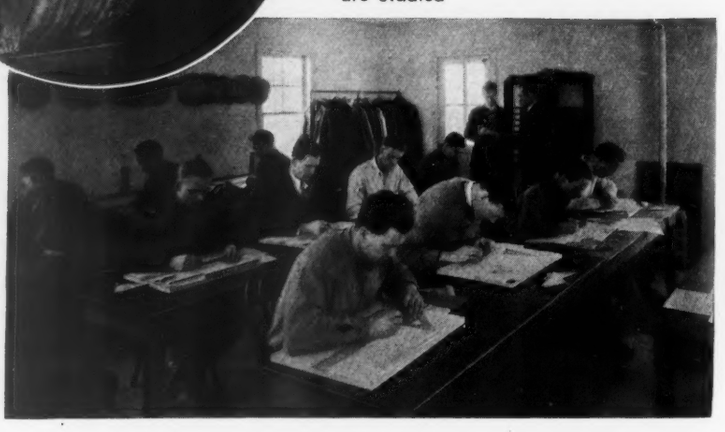
Men are required to spend three hours of their own time in the schoolhouse each week. There they study the technique of welding and cutting, blueprint reading, shop mathematics, practical metallurgy, electricity, and departmental economics.

But the activities of the training program are not limited to classroom work. The instructor spends eight hours in the plant every day. He acts as adviser and checker. He virtually lives with these men on the job. He discovers their mistakes and they bring their problems to him. He shows them how the work should be done; then he has them demonstrate to him that they understand. The idea isn't to make better scholars but better workmen who can "graduate" into better jobs.

One hundred and fifty hours of classroom work and 2,000 hours of

(Continued on advertising page 35)

"When you weld this seam . . ." Instructor Dale Wiley spends eight hours in the plant each day showing men how, answering their questions, making certain that they understand



Three hours of instruction in the schoolhouse supplement forty in the shop each week. Metal-working technique, blueprint reading, mathematics, metallurgy, electricity, and economics are studied

Time Study and Economic Balance

Known chiefly for its value in setting rates, time study is also a useful measure in comparing machine performances or production methods, and in solving problems of economic balance

J. E. BLACK
Production Engineer
Monroe Calculating Machine Company, Inc.
Orange, N. J.

A PREVIOUS article* discussed methods for setting production standards in such a way that time study personnel might be used more effectively. We shall now consider other uses for time study—that is, its uses purely as a measure.

Much has been written about dropping piece rates, particularly in the automobile industry. The change has certain advantages, but this industry is not dropping time study. The difference is that time study is now used as a measure of efficiency, and through it the automobile manufacturers expect to keep efficiency up to the point reached under piece rates.

There are plants outside of the automotive industry that use time study in practically the same way. In other words they pay a day rate higher than prevailing hourly rates for non-incentive work, but expect a certain output, which is determined by time study. It is similar to the old plan of differential day rates, one of the first incentive plans used. This is a use indirectly for rate setting, but the philosophy back of it is somewhat different from that generally accepted.

Time study may be used effectively by the manufacturer of machinery in making comparisons between his own and competitive products. Information so obtained may be used to advantage by both sales and development departments. It may be used to compare methods, in office work as well as in manufacturing procedures—for example, in the issuing of form letters by different devices such as automatic typewriters and multigraph machines; in the issuing of payrolls by cash or check; in the study of different machine tools. In this way intelligent decisions can be made as to which product to buy when quality considerations are equal or are not the controlling factors.

For Accurate Estimating

Time study is an invaluable aid to estimating. With sufficient data and experience it is easily possible to estimate costs within 10 per cent on a complete mechanism, and if the time spent on details is justified, more accurate estimates can be made. Estimates may be based on synthesis of accumulated data, or on experience gained by time study of similar operations. Usually a combination of the two is used.

Where formulas and tabulated data are used for setting standards, as discussed in my previous article, the estimates are as good as standards for cost purposes. In certain businesses, estimates furnished prospective customers are extremely important. An example of this is found in the machine tool industry, where estimates are often the basis for obtaining the order and good estimates are essential in having a satisfied customer after the same is made. In job work the accuracy of estimates may mean the difference between profit and loss.

The last use of time study data that will be discussed here is in the solution of problems of economic balance. This, to me, is one of time study's most interesting fields of application.

What Is Economic Balance?

What is meant by economic balance? When considering the manufacture of new products or ways of accomplishing a desired result, we usually have a variety of methods that *may* be used. Which *should* be used in order to meet the requirements and to show the lowest total cost over a given time or for a given number of units of product?

One of the leading engineering schools gives courses on economic balance in chemical industries. The same problems arise in any other industry and outside of manufacturing itself—that is, in distribution, in advertising, and in administration.

Getting at the Facts

The best way to approach this question of economic balance will be to give some specific problems. Please bear in mind that the important thing is not the problem but the principles involved and the method of analysis. It may seem that some of it is far removed from time study. Time study enters the picture in this way: We can do a thing by two methods. Each method has a different direct cost, different capital outlay, and different indirect cost. Which is the more economical way, or what is the economic range of each method?

Labor costs if known are based on time study, or they must be estimated; the estimates are obtained from accumulated time study data or accumulated time study experience. Likewise, indirect costs may be obtained partially from time

*"We Set 76% of Our Rates from Master Studies," May, page 177.

study, and very often some of the capital expenses may be obtained from time study. The fact that some of these factors are not generally so obtained, does not mean that it is not a proper field for time study.

First let us consider problems of method and tooling. Methods are important in any industry, and tooling is part of methods in the metal-working industries. Tooling is especially important where a large number of items are manufactured, where the usage of each item covers a wide range, and where obsolescence is relatively high.

Approach Is Important

The method of approach is this: For any given method we have a certain initial outlay. This plus the manufacturing cost represents the total cost of producing the given number of parts by this method. We must know, or have estimates of, the number of pieces to be produced, the initial outlay, and the manufacturing cost of each. These may be set up as formulas for total cost in terms of number of pieces produced.

Total costs of two methods may then be equated, and the equation solved for the number of pieces that will be the economic point. This way of obtaining the economic point will be used in some of the problems that follow.

Another way is to make charts, plotting total cost against pieces produced. This method is better when considering tooling since we are usually interested in the economic range as well as in the economic points, and charts give a better picture. This is particularly true when there are more than two methods that have a definite economic range.

Figure 1 shows curves for several ways of producing a part. The point at which these lines start on the cost axis (zero pieces produced) is the initial cost. The slope represents the cost per piece. Method I has an extremely low production cost, although the initial cost is the highest. Method III has the lowest initial cost but the greatest production cost. Up to 5,000 pieces, III should be used. From 5,000 to 13,600 pieces, II should be used. Over 13,600 pieces, Method I should be used.

Line IV represents a low production method in general use today, but analysis showed that it had not economic range. Conditions such as this occur in well-managed plants. A thing is often done because it is common practice, without making an analysis to find out whether there is a good reason for it. Another advantage of this approach to tooling and methods is that it brings attention upon relative costs.

In this case an effort was made to develop an original method more satisfactory than any existing ones. The result was that shown by dotted line V. This method is economical up to 32,000 pieces, beyond which Method I is the more economical.

This study was made a few years ago when it was important to keep initial costs down and still get satisfactory production costs, because of low production and obsolescence after a relatively small number of pieces had been produced. Low initial costs also mean that there is less delay in producing new designs, since this cost indirectly represents less tooling labor.

Consider All Cost Factors

Work produced in any one plant may usually be divided into groups of similar items. Charts similar to the one shown may then be drawn up for each group. In determining these groups, variables that might cause significant differences in initial cost or production costs must be isolated, and the parts or items grouped accordingly. For example, we might consider as one group small blanks with two holes.

When an analysis of this kind is made, all important cost factors should be considered. Set-up, for example, is directly chargeable to the method and should be part of the cost. Likewise, any other factors that are inseparable from the method should be considered. One method may require high maintenance of tools or equipment; one method may require high energy consumption as compared to another; or one method may require more supplies than another. When that is true, these factors should be accounted for in the cost of that method.

Overhead is important. There seems to be no general practice as to how much overhead to add, if any, when comparing costs of various methods. I am of the opinion that some overhead should be added. For example, set-up is certainly a cost of producing an order of parts. For an order of a few thousand pieces on a screw machine, a 3-hr. set-up at a high rate represents a large part of the cost of the order when we consider that we have a low labor-hour rate with an operator running a battery of machines. Likewise, there are other parts of overhead directly chargeable to the order. Consideration of overhead to be applied is important in the problems that follow.

Watch Your Paperwork

There is one thing to remember. We are obtaining economic balance —let us not do an uneconomical amount of paperwork. Where there is a volume of similar work, the

(Continued on advertising page 36)

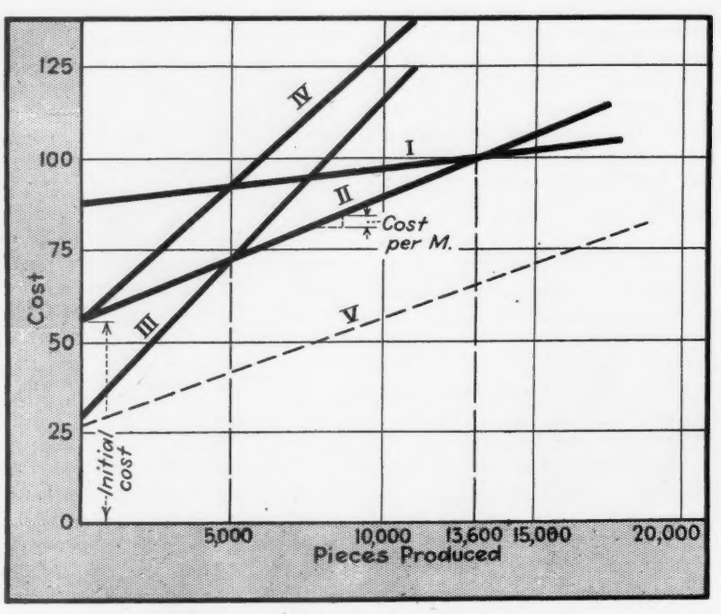
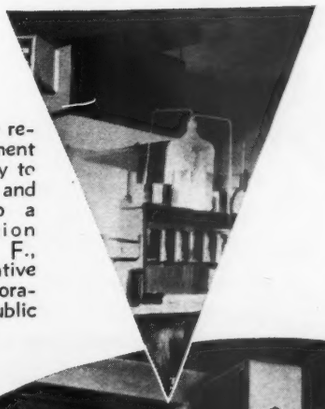


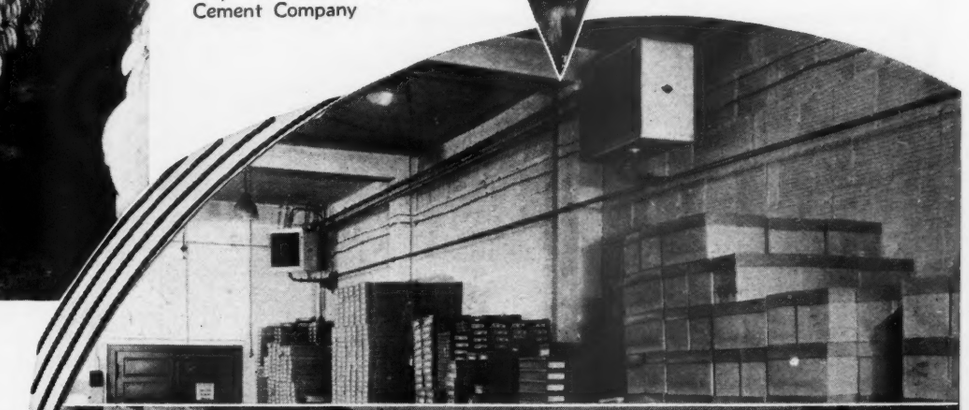
FIGURE 1. A chart made by plotting total cost against pieces produced, gives curves for several ways of producing a part

FOR THE SAKE OF THE PRODUCT ~

Air Conditioning



To obtain comparable results when testing cement samples it is necessary to control temperature and humidity closely; so a Kelvinator installation maintains 70 deg. F., 60-65 per cent relative humidity, in the laboratory of the Republic Cement Company



In this air-conditioned (Trane) storage and ripening room bananas can be ripened quickly or slowly, to meet current market conditions

•

Keeping the chocolate candy storage room cool is the job assigned to an Ilg cooling unit in the Bard and Margolies plant

•

At Corral Wodiska y Ca. loose cigars have excess moisture content reduced before cellophane wrapping by storage for 36 to 72 hours in an air-conditioned (Carrier) room

•

Good candy can't be made in just any kind of weather. Fanny Farmer doesn't try to, depends on a York air conditioner

Five Times Safer

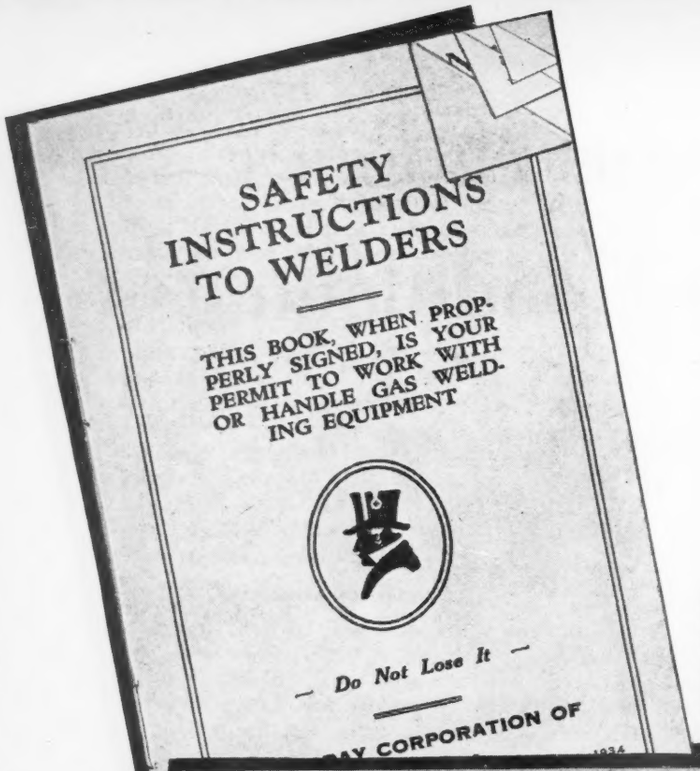
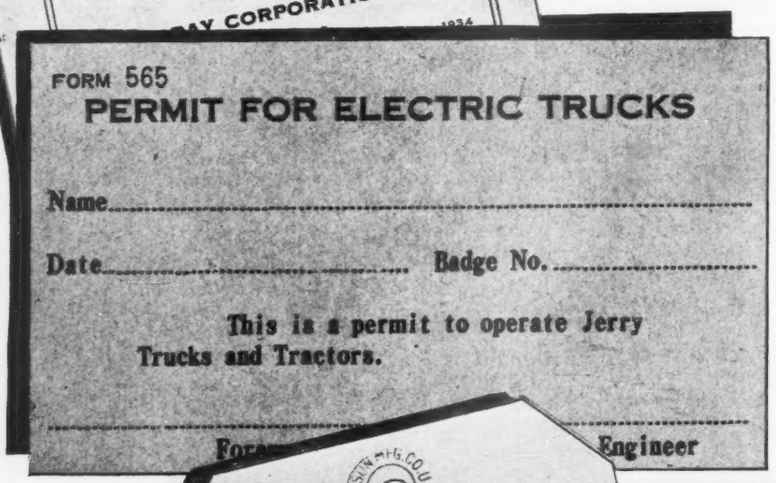

SAFETY INSTRUCTIONS TO WELDERS
THIS BOOK, WHEN PROPERLY SIGNED, IS YOUR PERMIT TO WORK WITH OR HANDLE GAS WELDING EQUIPMENT
— Do Not Lose It —

FIGURE 1. Every welder must know these special instructions, have a welder's permit signed by his foreman and the Safety Engineer



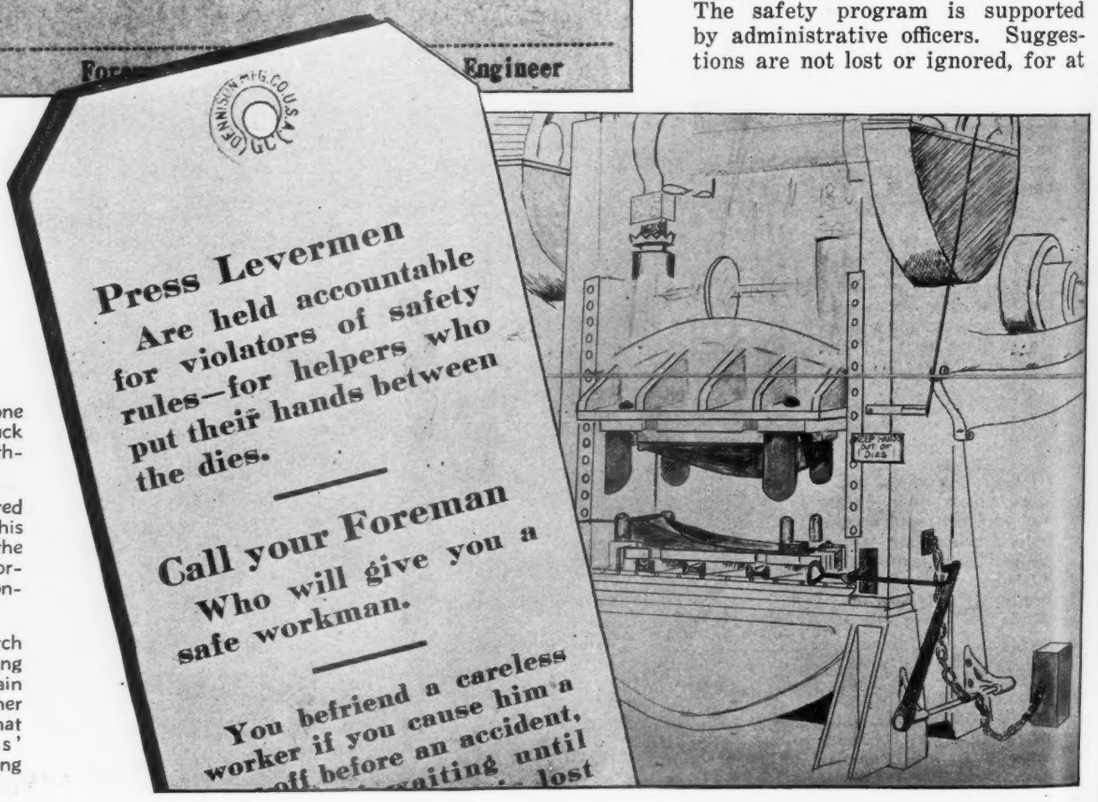

Press Levermen
Are held accountable for violators of safety rules—for helpers who put their hands between the dies.
Call your Foreman
Who will give you a safe workman.
You befriend a careless worker if you cause him a

FIGURE 2. No one can operate a truck or a tractor without a permit

FIGURE 3. This red tag attached to his machine keeps the press operator forever safety conscious

FIGURE 4. Sketch of press showing safety block, chain slots, and leather "low bridge" that keeps workers' hands from getting into trouble

A SAFETY COMMITTEE meeting in the Die Department notes an unsafe practice that only the President or the Manufacturing Manager can remedy. Very well, the Safety Engineer who is meeting with the committee enters their names after the point in question. The minutes of this committee and all departmental safety committees are published monthly. Copies go to all committee chairmen, heads of departments, the Manufacturing Manager, and the President. The Safety Engineer is charged with following all suggestions to a conclusion before the next monthly meeting, including the items checked as the President's responsibility.

In this fashion safety committees are made to function as an integral part of the organization at the Murray Corporation of America. The safety program is supported by administrative officers. Suggestions are not lost or ignored, for at

Than in '29

Murray Corporation of America hangs up enviable record; cuts number of accidents to 22 per cent of what it used to be; doesn't do a thing that any other concern can't do

R. A. SHAW
Safety Director
Murray Corporation of America
Detroit

the end of the month the Safety Engineer must report to the Manufacturing Manager all suggestions that have not been concluded, or report progress on all open ones.

Each department has its own safety committee, drawn from the supervisory staff. Monthly meeting dates are so staggered that the Safety Engineer is able to attend all meetings. Combined minutes of all committees are published by the tenth of the succeeding month, and are bound in a cover carrying a safety message. The educational feature of safety is never neglected. Safety rallies are held at periodic intervals where corrective safety measures are outlined to workmen.

Results

The effect that these safety policies have had on the number of accidents of a serious nature indictates the effectiveness of the program. If all such accidents in the operating year 1929-30 be expressed as one, or unity, the following five years, including that of 1934-35, bear these relations to that datum point; 0.46, 0.21, 0.14, 0.44, 0.22.

Rise in the number of accidents in 1933-34 to 0.44 as compared with a marked reduction in the preceding years is explained by the rapid expansion of activities as a result of the pick-up of the automobile industry. New workers not before used to industrial processes and old workers who had lost much of the feel for the job were necessarily introduced to difficult work. The reduction of the number of accidents to 0.22 in the past year illustrates the effectiveness of the safety education program.

The Important 20 Per Cent

Some six years ago an appropriation of several thousand dollars was made by the Murray Board of Directors for the purpose of guarding open gears and clutches, for the provision of proper ladders, crane landings, and belt guards. It is said that only 20 per cent of accidents are prevented by such mechanical devices, but this company feels that safety education and safety committees have little chance of producing worthwhile results unless the company first demonstrates to its workers that, by installing these mechanical devices, the policy-forming administration takes the question of safety seriously.

Operations carried on in the Murray Corporation are hazardous unless properly guarded and unless operators are thoroughly instructed in safety practices. Presswork, die production, the placing of dies in the presses, welding, painting, and trimming involve the handling of heavy and somewhat unwieldy pieces of material where accidents due to falling work, flying particles, and failure of mechanical handling devices may be prevalent unless the organization and the workers are made safety-conscious.

At each main gate—a constant reminder that this must be made a safe plant to work in

The New Worker

With adequately guarded equipment, the new employee is introduced to safety in an especially effective way at the time of employment. After the new employee has been checked as to references and has passed his physical examination, the interviewer presents him with a set of general company rules and discusses with him the significance of each rule. Under "conduct," for example, he is informed that a layoff will result from "failure to wear or use safety equipment or to keep safety rules," that discharge is the penalty for repeated breaking of this and other specific rules.

Certain jobs, such as welding, crane and elevator operation, sawing, and others have special rules pertaining to their safe operation. Welders, for instance, get the booklet shown in Figure 1.

The foreman of the department to

which the new employee is assigned, explains this set of rules to him. The foreman must test the new man as to his ability to work safely. If he is convinced that the new man can work safely, he signs the permit at the back of the special rule book. This permit is countersigned by the Safety Engineer, and the worker is required to keep it on his person at all times as evidence of his right to work at his job.

Prospective operators of electric trucks find the same requirements as to safety. The examination given by the foreman before he signs the operator's permit (Figure 2) is more rigorous than most examinations given prospective drivers of automobiles on the highways.

Presswork

This type of work is hazardous, especially with indifferent or careless workmen. Even though tongs or special slides may be provided as feeding means, the dies and presses have to be changed and repaired with the attendant danger of falling dies and moving parts of the press. As in other operations, the Murray Corporation places definite responsibility for safe operation on one individual, in this case the press leverman. Not only has the latter been certified as a safe operator, but he is constantly reminded of his responsibility to his helpers by the red tag attached to his press. See Figure 3.

Handling dies into and out of a press must be done carefully and in certain ways if accidents are to be avoided. All presses have wooden blocks chained to them which are to be placed between punch and plate while repairs are going on. Chain slots are built into all dies to prevent slippage, and a leather "low bridge" protects all guide pins, or rather prevents the worker from getting his hands over them. See Figure 4. Inlets cast into the base of the die prevent loosening due to built-up clamps. Each chain, crane, and similar device for handling work is inspected each month by the Safety Engineer or his representative.

Safety campaigns with prizes for best performance are old in the safety movement. A new emphasis, however, is given by the Murray Corporation. Each of the numerous departments is budgeted as to the expenditures anticipated for accidents—at so many cents per $100 of payroll. Allowances vary from 10 to 35 cents. No allowance is made for major accidents, nor is it expected that departments will countenance accidents merely because there is a budget provision. The budget is more in the nature of an educational device to keep this phase of operation uppermost in the minds of supervision.

For the six months ending December 31, 1935, the Maintenance Department, prolific in lost fingers and toes in any organization, consumed only 10 per cent of its 20c. budget; the Press Department, 46 per cent of a 35c. allowance. Allowances set up for the different departments vary in proportion to the differentiation recognized between classes of work established by private insurance companies. Three cash prizes are given. For the contest starting January 1, budget allowances are adjusted downward in agreement with performances.

All accidents of a minor nature are investigated by the Safety Engineer to determine if any preventive measures can be taken to prevent their repetition. Major accidents, involving permanent loss or broken bones, are considered by an investigating board composed of the Division Superintendent, the Safety Engineer, the injured worker when possible, and witnesses. Reasons for the accident and the responsibility for it are established by this board and recommendations made by it in writing to the Manufacturing Manager as to advisable changes in equipment or disciplinary measures to be adopted. The recommendations, reviewed by the Director of Industrial Relations before going to the Manufacturing Manager, are followed explicitly and are used in impressing the humanitarian side of safety work on members of the organization. In addition, the economic side is stressed by monthly reports of accidents and their cost made by the Compensation Department. Copies of this report go to department heads and chairmen of safety committees.

Safe Housekeeping

A careful analysis of accidents will show that a substantial portion is due to littered floors, aisles poorly marked and congested, dirty lighting fixtures and windows, and other items of faulty housekeeping.

In line with safety education, the management told department heads to clean up and stay clean. Strict disciplinary action was taken where this order was not fully respected. But the management did not rest with this clean-up order. A safe housekeeping campaign was instituted, the end result desired being a safe shop in which to work. A reviewing committee appraised each department periodically and issued a monthly report establishing departmental ranking.

It is a common experience that small departments are able consistently to walk away with the safe housekeeping prize, and hence throw the whole program into disrepute. But not so in the Murray plan. A relative ranking was provided based on the space occupied. For example, in judging aisle cleanliness a department occupying 10,000 sq.ft. of space would be penalized one-half as much as a department with 5,000 sq.ft. and with the same aisle condition.

This form of education was used for two years, but having made the staff housekeeping conscious, it is no longer used, and the Manufacturing Manager has issued instructions that all departments be cleaned and be kept so, conscious of the fact that a sufficient habit pattern has been developed to make such orders effective.

In summary, it may be said that reduction in the number of accidents and their severity during the past five years at the Murray Corporation is due to adequate mechanical safeguards, to a habit-forming educational program backed by rigid discipline, to the integration of safety committees with the major objectives of company policy, and to the insistence on the part of higher management that unsafe conditions, as discovered, shall be the responsibility of a definite individual in the organization until they are eliminated.

Credit much of the improvement in accident frequency to safe housekeeping

Standard Costs for Profit Control

Standards—the author is not the first to wish that the expression "standard costs" might be changed to "standards"—are simply measuring sticks of accomplishment. They represent a goal toward which progress may be chalked up. Properly used, they mean close control of production costs

PAUL E. GNAEDINGER
Industrial Engineer, Dominion Rubber Company, Ltd.
Montreal

PREVIOUS installments of this article were published in April and May. In this third and final section Mr. Gnaedinger continues with a discussion of cost variations and ratios, concludes with an analysis of the value of standard cost methods.

Accounting to Secure Cost Variations and Ratios

It is inevitable in the development of a comparatively new technique that various theories should be advanced involving different principles, and it is important that any contemplated installation of standard costs should be carefully considered from the angle of the methods employed and the problems encountered in the operation of each type. The types can be broadly classified as follows:

1. In which process accounts are debited at actual and credited at standard. Variations must be determined and cleared from inventory account to variation accounts.

2. In which process accounts are debited and credited at actual and standard both, for purposes of obtaining ratios and comparisons without carrying variations to profit and loss statement.

3. In which process accounts are debited and credited at standard, and difference between actual and standard values is charged directly to variation accounts. In this case finished goods inventory account and cost of sales are also at standard values.

The third type is probably the most comprehensive because the variations and manufacturing cost inefficiencies are shown up directly in the income and profit and loss statements, thereby possibly attaching greater importance and laying more emphasis on any inefficiencies that are revealed. However, without discussing the relative merits of each type, the general underlying principles can be illustrated by a description of a type wherein all inventory values and cost of sales are at standard values—except raw materials and supplies, which are carried at actual cost—and cost variations from standard are charged to profit and loss.

Materials—It is the intention in this plan to carry raw material inventories at actual prices and values, whereas material-in-process is carried at all times at standard value. As material is issued from stores to producing departments, it is priced at actual and standard both. Raw material account is credited with the actual value, work-in-process being charged with the standard value, and the difference between the standard and actual value is charged or credited to an account known as the purchase variation account.

For example, support that standard value of material *A* issued during a month amounted to $10,000, whereas actual value was $10,500. Following entries would be made:

Credit raw materials ...	$10,500
Debit material in process	$10,000
Debit purchase variation	$500

Since the purchase variation is a profit and loss sub-account the management can see that potential profits for the period were reduced by $500 because purchase prices were higher than anticipated.

To obtain actual costs of any articles containing material *A*, it is necessary to multiply standard value of this material by the ratio 10,500/10,000 or 1.05. Thus, if standard value of this material in a certain product is $2, actual value for this particular month would be $2 $\times$ 1.05 = $2.10.

It is advisable to determine purchase variations for each material of importance.

By the introduction of suitable plant operating or performance records it is possible to determine fluctuations in consumption of material in excess of or less than standard quantities. These variations are known as usage variations.

Here again, by evaluating standard and actual quantities at standard prices, amount of variation can be arrived at and charged to a usage variation account, and a ratio can also be found to adjust standard article costs to actual.

Labor—With regard to labor, reports are instituted which record all labor costs known to be in excess of standard — for example, waiting time that is paid for, apprentice training cost, etc. These amounts are credited to accrued payroll account and charged directly to suitable labor variation accounts. Labor-in-process account is debited with standard labor cost of work that has actually been performed during the month. For example, if piecework is in effect, labor-in-process will be charged with total piecework labor cost. All labor cost excesses are

charged directly to suitable labor variation accounts from accrued payroll account.

Burden — The burden-in-process account is charged with an amount equivalent to standard labor cost multiplied by the overhead ratio on direct labor that was used in cost estimates. Difference between amount charged to burden-in-process and actual burden is charged to burden variation account.

Burden variation is made up of two distinct amounts. First, there is the amount of variation caused by expenditure of more or less than amount allowed in budget for actual capacity operated. This is an efficiency variation. Second, there is the variation due to under- or over-absorption of overhead in cases where the plant operated at a level lower or higher than normal production volume. This is known as volume variation expense, sometimes as idleness expense.

To illustrate this point, let us assume that standard burden rate is 110 per cent of direct labor, and that the following performance was established during a specific month:

Actual capacity	60%
Actual burden	$8,000
Burden budget at 60% ..	$7,600
Standard direct labor ...	$6,000
Standard burden at 110% of direct labor	$6,600

It is obvious from these figures that since the management failed to reduce the expense to predetermined budget allowance there was an excess cost amounting to:

$$\$8,000 - \$7,600 = \$400$$

Also, whereas predetermined standard burden was $7,600, volume of production, which was below normal, absorbed only $6,600. Consequently there was an excess cost due to volume variation or idleness expense amounting to:

$$\$7,600 - \$6,600 = \$1,000$$

Total burden variation, therefore, is $1,400, and the ratio for the month is

$$8,000/6,600 = 1.21$$

Scrap—Actual value of scrap produced during the month must be determined and evaluated by its labor, material, and burden content. These amounts respectively are credited to work-in-process accounts and charged to scrap variation account.

Entries for Production

Production for the month is summarized by lines and styles, and each quantity is extended by standard labor, material, burden, and scrap standard cost. For example, assume that standard cost of monthly production as obtained from extension of quantities by standard cost was as follows:

Material	$ 8,000
Direct labor	6,000
Burden	6,600
Scrap	1,400
Total	$22,000

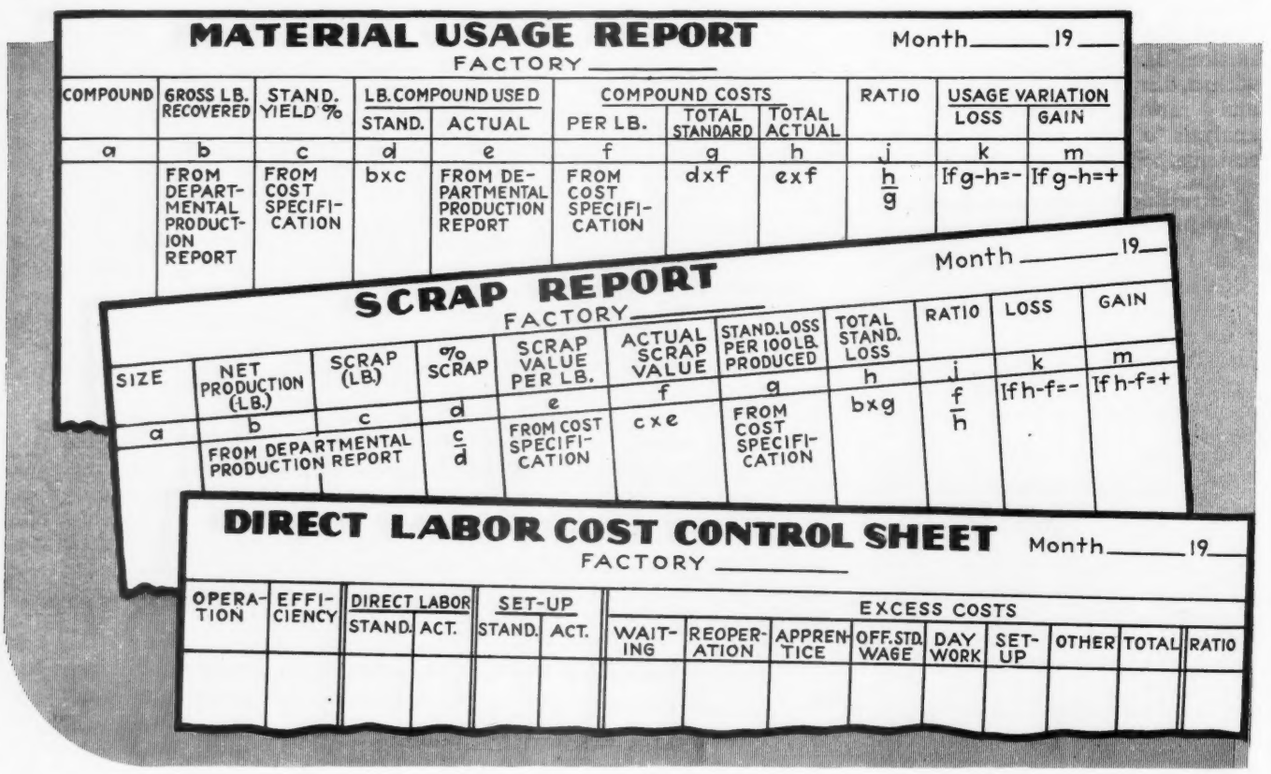
Accounting entries would be as follows: Debit finished goods inventory account $22,000; credit the various work-in-process accounts with amounts shown.

The cost department, after preparing and making all of the above-mentioned journal entries, has effected the necessary entries to maintain the work-in-process at standard value.

An important step, which must now be made, is a verification of the amount shown as work-in-process inventory—that is, the amount remaining in process accounts after all debits and credits have been made for the month. This verification may be made by estimating in-

(Continued on advertising page 39)

MATERIAL USAGE and **SCRAP REPORTS** convert into dollars and cents the gains or losses due to variations from standard yield and scrap percentages. **DIRECT LABOR COST CONTROL SHEET** summarizes for control purposes the information contained on the Direct Labor Cost Summary—see May, page 187



MATERIAL USAGE REPORT Month_____ 19____ FACTORY _____

COMPOUND	GROSS LB. RECOVERED	STAND. YIELD %	LB. COMPOUND USED		COMPOUND COSTS			RATIO	USAGE VARIATION	
			STAND.	ACTUAL	PER LB.	TOTAL STANDARD	TOTAL ACTUAL		LOSS	GAIN
a	b	c	d	e	f	g	h	j	k	m
	FROM DEPARTMENTAL PRODUCTION REPORT	FROM COST SPECIFICATION	bxc	FROM DEPARTMENTAL PRODUCTION REPORT	FROM COST SPECIFICATION	dxf	exf	$\frac{h}{g}$	If g-h=-	If g-h=+

SCRAP REPORT Month_____ 19____ FACTORY _____

SIZE	NET PRODUCTION (LB.)	SCRAP (LB.)	% SCRAP	SCRAP VALUE PER LB.	ACTUAL SCRAP VALUE	STAND. LOSS PER 100 LB. PRODUCED	TOTAL STAND. LOSS	RATIO	LOSS	GAIN
a	b	c	d	e	f	g	h	j	k	m
	FROM DEPARTMENTAL PRODUCTION REPORT		$\frac{c}{d}$	FROM COST SPECIFICATION	cxe	FROM COST SPECIFICATION	bxg	$\frac{f}{h}$	If h-f=-	If h-f=+

DIRECT LABOR COST CONTROL SHEET Month_____ 19____ FACTORY _____

OPERATION	EFFICIENCY	DIRECT LABOR		SET-UP		EXCESS COSTS								
		STAND.	ACT.	STAND.	ACT.	WAITING	REOPERATION	APPRENTICE	OFF. STD. WAGE	DAY WORK	SET-UP	OTHER	TOTAL	RATIO

If the worker only knew

Wouldn't he be strong for Employee Representation?

. . . we'll also talk hours and wages, which is what we're most interested in

"GOING TO vote for the Employee Representation plan, Ed?" With both their planers settled down on long cuts, Sam has ambled over to Big Ed's machine, from which he can keep an eye on his own.

"Sure am, Sam, and I don't mind telling you I'd like to be a representative."

"Well, you know you're sure of my vote, whenever election is held. But first we have to vote about accepting the plan, don't we?"

"That's right."

"How'd the thing start, Ed? Did the front office tell us to take it up?"

"Wait a minute, Sam. Let's get this straight. The front office didn't *tell* us to do it—and didn't *ask* us to do it—and didn't give us any plan. Wish they *had* helped us work it up, but they wouldn't. Afraid they'd be accused of coercion, or undue influence, I suppose. Far as I can see, it's the plan that counts, not who put it down on paper. We had some job getting things straight."

"Who's we?"

"Well, I'm part of we. Frank Wright of the lathe department is part, so is Jim Burroughs of milling, Tom Smith of drilling, John Roach of assembly. There are two or three others."

"And you fellows worked the whole thing out without any help?"

"Of course not, Ed. We got hold of the plans of 15 or 20 other companies. And we've been reading a lot about it in industry publications. I had clippings of articles that gave actual plans."

"As I understand it, we employees are going to elect representatives to sit down with representatives of the management and discuss our problems. That right? Talk about safety, I suppose, and working conditions—and that's about all."

"Oh, no. We'll talk about those things, but we'll also talk hours and wages, which are what we're most interested in."

"And what will the management people talk about, Ed?"

"Same things. And I hope they'll talk about a lot more—orders, costs, profits, for example."

"You think they will? Think we'll really find out who gets all the gravy?"

"I see you still have the impression that somebody is getting an awful lot of money out of this place. Yes, I think you'll really find out now why planer hands can't get as much as presidents—or even foremen."

"Well, suppose we do get all the dope—and we still want more money, or shorter hours, and the bosses say 'No,' what can we do then? If we don't belong to a union we can't strike, because there won't be any benefits and we can't hold out."

"The way our plan is written, Sam, things don't end up in disagreement. Differences are taken up and up, until they can finally be referred to outside disinterested arbitrators. That's the way a lot of the good plans work."

"But Ed, why should we go to all that trouble? Why not join a union to start with and have everything looked after for us?"

"That's easy, Sam. You wouldn't *know* any more then than you know now. You'd be *told* a lot of things. You'd be *told* you had more coming to you. You'd be *told* to go on strike to get it. But you wouldn't be taking action on your own judgment, and you might be told to do the very thing that would hurt you worst."

"But won't my representatives be telling me what to do if we have employee representation?"

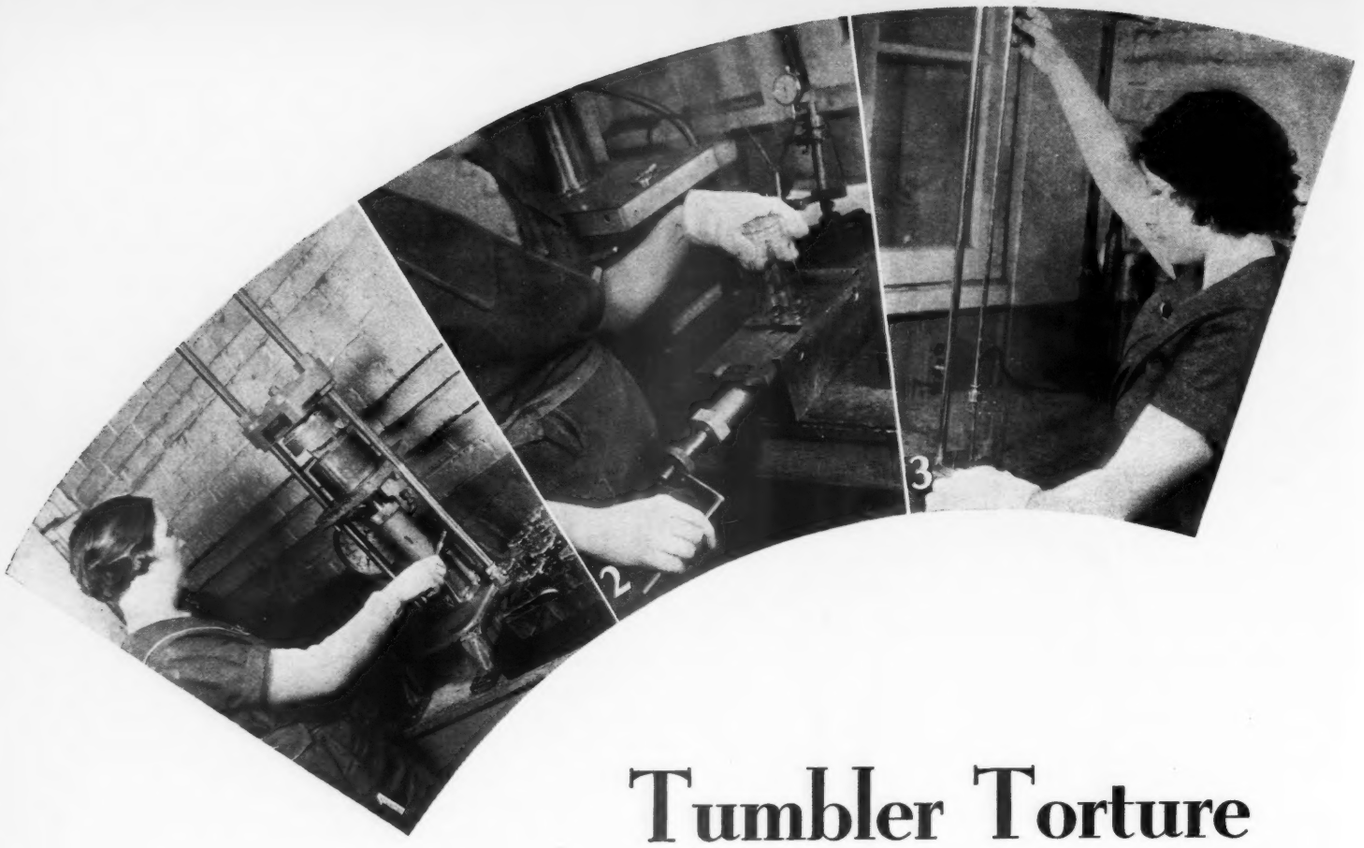
"Yes, to some extent. But they'll be men you know well. And as an individual you can take even a personal grievance to your employer. And the representatives don't set your wages, and make them the same as everybody else's. And you don't pay any dues to support organizers who all too frequently get workers no place except into hot water."

"You see plenty of advantages then, Ed?"

"You bet I do, Sam, and I'm going to work for the adoption of the plan."

•

The series to date: 30-hour Week; Townsend Plan; Labor Relations Law; Taxes; Mechanization; Employee Representation. Each available in 3x5 pamphlet form for management to distribute to workers



Tumbler Torture

★

How the familiar "proving ground" idea may be lifted out of the automotive industry and adapted to the somewhat different problem of finding out how a fragile product like fine glassware will behave when used

HAROLD SCHULTZ
Chief Engineer
Libbey Glass Manufacturing Company
Toledo

TUMBLER mortality has been exceedingly high for years because the general public has consistently subjected glassware to careless abuses in handling and washing. As a result, one of our big jobs has been to build toughness into a piece of thin glassware. How well we have succeeded is seen by the reaction of the Libbey product to the wide assortment of "tumbler tortures" we have devised.

Many of the "tortures" are especially designed to reproduce in exaggerated form the common causes of tumbler breakage. The three tests illustrated are typical of the ten whose descriptions follow:

1. TENSILE STRENGTH . . . simulates common household practice of jamming towel and hand into glass while drying it. Tumbler is placed over two rubber-covered prongs, which are gradually separated until glass breaks.

2. SHOCK RESISTANCE . . . reproduces shock caused by bumping rim against faucet. Movable 2-oz. weight is dropped from heights up to 36 in., strikes rim with sharp impact.

3. HYDRAULIC PRESSURE . . . determines how much pressure tumbler will stand. Pressure applied until crushing point is reached.

4. WALL STRENGTH . . . 2-oz. weight at end of swinging arm 12 in. long is dropped from various heights against inside wall. Test simulates shock caused by contact with faucet.

5. TEMPERATURE . . . tumbler immersed in, then filled with, boiling water and suddenly transferred to tank of ice water at 42 degrees.

6. WALL THICKNESS . . . gaged with dial-indicating micrometer. Deficiency of a thousandth of an inch is easily detected.

7. COLOR . . . is checked by taking a hand proof of molten glass at frequent intervals. Corrections are then made, if necessary, to insure uniform water-white color.

8. TOLERANCE . . . at beginning of every production run, items are picked at random and compared with master samples and blueprints as to height, weight, wall thickness, etc.

9. CAPACITY . . . every two hours capacity accuracy in cubic centimeters of tumblers is checked.

10. WEIGHT . . . to insure proper weight, balance, and uniformity of wall thickness, glassware is weighed every two hours and checked against specifications.

Not a test, but a typical example of Libbey research, were recent batch experimenting operations. For several months and at a cost of several thousand dollars, one furnace was devoted to the melting of 180 separate batches. Sample tumblers were made from each batch and subjected to regular tests and inspections in a further effort to improve the quality of the product.

Penetrating the Skin of Industry

Rare is the industry whose workers do not have one or more excellent chances of picking up an occupational skin disease. In this article and its predecessor (May, page 179) Dr. McCord tells the story of trade dermatitis in a manner calculated to get under management's hide

CAREY P. McCORD, M.D.
Medical Director
Industrial Health Conservancy Laboratories
Cincinnati

TO THE uninitiated, it may appear that only one form of industrial skin disease arises. This well-known form is from direct contact with a chemical irritant, resulting in what the layman terms a "burn." Contrariwise it might be shown that the manner of action leading to the disturbed skin is to be reckoned in dozens.

Golf balls are said to be better if they have a central space about the size of a hazelnut—but how to provide this hollow? Certainly rubber threading may not be wound around spherical space. Some manufacturers overcome this difficulty by winding the rubber around pellets of dry ice, at a temperature of about 100 degrees below zero. In due time the dry ice evaporates and the gas diffuses through the rubber, leaving the center hollow. In handling these pellets the workers, unless protected, acquire a dermatosis of the finger tips—caused by freezing.

From Oft-Repeated Pressure

The old-time clarinet player presents himself to the physician with a hard, thickened, corny lip. This is a true occupational skin disease produced by pressure. The violinist finds *his* corns on the tips of the fingers of his left hand; the harpist on both hands; the shoemaker on his knees; the potter on his left palm; the textile cutter over his thumb; the bottle blower on his knuckles; the basket maker on his little fingers —all from sustained or oft-repeated pressure.

The insecticide maker may day by day breathe into his lungs small quantities of arsenic. In the course of months he loses his nails and hair, and over his body appears "arsenic pox"—an industrial skin affection following systemic poisoning.

The X-ray technician carelessly exposes himself to roentgen rays by leaving off his leaded gauntlets, or by failing to stand behind the leaded glass partition designed for his protection. In due time, along with the sterility that may become his lot, he develops X-ray "burns" of the skin.

The marble cutter, working with a pneumatic chisel at 2,000 strokes per minute, develops cold, white, numb fingers. The vibration in this "white fingered" disease induces a continuous spasm of the tiny blood vessels of the skin—and another industrial dermatosis is the result.

Two young women in an artificial flower factory incur a distressing skin disorder. One of the women also suffers from asthma. They seek to blame the glues, the resins, the dyes, the feathers, the metal foils, the waxes, the adhesive tapes handled in their daily work. Patch tests are carried out, in which samples of all these substances are applied to their skins. Negative results are obtained throughout.

A more rigorous inquiry is necessary. Other substances must be tested. It is noted that a friendly cat stalks about on the counters and sleeps on the unoccupied chairs. The investigator clips off a wisp of fur from the cat, and applies it as a patch test. Twenty-four hours later, a distinct inflamed area has developed. The mystery is solved—dermatitis from sensitization, an allergic condition—not a true industrial dermatitis, but no less a dermatitis growing out of the industrial environment.

Cancers of the Skin

Skin cancers contribute a small but significant portion to the totality of industrial skin diseases. The paraffin worker, such as the candle maker, may after years of exposure learn that his skin is afflicted by one or more slowly growing cancers. Many substances used by industry contain just such carcino - genetic agents. These are to be found in shale oil, in various other distillates of coal and petroleum, in arsenic, and possibly in some aniline dyes.

A skin afflicted worker blames his materials

Many industrial dermatoses are accompanied by ringworm. To the lay mind a ringworm of the skin is annular in appearance, ever

spreading at the periphery, ever healing at the inner border of the injured zone. Quite contrariwise it may be pointed out that dozens of forms of fungous disease popularly termed ringworm never assume circular form. These fungus parasites at the present time participate in the production of the most refractory industrial skin diseases. More often than not they do not originate the trade dermatitis, but instead merely gain a foothold in a skin already trivially damaged by industry's injurious substances.

Just as there are many ways of killing a cat, so there are many approaches and many modes of action by the industrial enemies of normal skin. However, the afflicted and disabled worker is chiefly concerned in his pain and loss of time and income rather than in the fact that his particular affection results from the action of a dessicator or an anhydride or a keratin solvent; and the employer is similarly more concerned over lowered production and compensation losses than in the fact that the skin diseases present in his plant are produced by an allergic or a neoplastic or a hydrolytic agent.

Industry Pays and Pays

Many an employer, month in and month out, delivers compensation checks to skin-affected workers whose conditions in no degree have been produced by industry's processes. On Sunday the laundry's dry cleaner goes on a picnic; on Monday he is alarmed over a hot and painful rash on his arms; on Tuesday he blames the detergent solvent used in his work; on Wednesday he consults a physician; on Thursday he presents a claim for "dermatitis venenata"; on Friday he talks disgruntledly of filing a law suit; on Saturday he makes an inflammatory speech before his union, waving his bandaged arms; then on Sunday, again meeting his friends, he discovers that they too have a poison ivy dermatitis from last Sunday's excursion.

Materials Get Blamed

The somewhat elderly tender of the gasoline station is a bit constipated. Through advertisements he learns of a "perfect" laxative, pleasant to take, easy to carry around in a vest pocket, inexpensive in price. After a few doses, he discovers several splotches on his body. With desire influencing his thought he looks with suspicion to his gasolines, his oils, his anti-freeze compounds.

To the old aphorism that "A poor workman blames his tools," and a new one—"A skin-afflicted worker blames his work materials." This station tender harbors no true occupational dermatitis. Instead, he is suffering from phenolphthalein poisoning. Dozens of proprietary cathartics and laxatives contain this dangerous agent. Long after discarding such drugs, the skin affection may persist. Generally — and generously—industry, uncertain as to just what may provoke a true occupational disease of the skin, accepts this spurious type along with the genuine and makes compensation payments.

General appearances of many forms of occupational dermatoses do not set them apart from many other kinds created by causes wholly unrelated to work. The worker who pulls weeds in his garden after hours develops the same abnormality of the skin as the worker who washes metal parts in a soda-ash bath at the factory. The redness, the papules, the vesicles look to be the same.

One worker is furnished at his home with a cheap alkali soap by his thrifty wife. Another worker in the same shop uses a rubber cement containing benzol as the solvent. Each develops the same appearances in a disabling skin affection.

A girl worker in her quest for beauty applies to her hands harmful concoctions appealingly advertised to the vanity of womankind. In the next bay a girl molds electric plugs from Bakelite powder. Each girl develops a dermatitis—identical in appearance. Each, equally indignant, appeals to the management for a monetary balm.

Unnecessary Waste

Trade follows the flag, but dermatoses follow the trade. Few are the exceptions. Occupational diseases of the skin are by no means limited to a few highly industrialized centers—the Akrons, the Birminghams, the Copenhagens, or the Detroits. Instead, dermatoses may be found among the asphalt diggers in Trinidad, the cocobolo wood cutters in Central America, the hop pickers of California, the petroleum workers of Iran, the linseed oil makers of the Argentine.

Industrial dermatoses, numerically the outstanding representative of occupational diseases in their entirety, are preventable and controllable. They represent unnecessary wastage. To ignore them, along with other forms of occupational diseases, provides some evidence of industrial amblyopia. The genius of industry needs application not only to production and budgets, but to the health hazards of workers as well.

It is not sufficient that you may show that for every unit of your production, whether it be a refrigerator, a bedstead, or a baby buggy, your cost for the care of industrial diseases has been only a hundredth part of a cent. One hundred cases of skin diseases in industry, regardless of their cost, mean one hundred uncomfortable workers, irritable, discontented — fertile soil for the growth of unhealthy ideas, ready listeners to the whisperings and bickerings of evil planners.

On Sunday the laundry's dry cleaner goes on a picnic . . .

For Every Job a Rating

Task ratings stimulate output. Workers get more money. Management gets lower costs, sells more goods, has more jobs to offer

PHILIP BERNSTEIN
Time Study Engineer and Job Analyst
Winchester Repeating Arms Company, New Haven

EVERY operative in a production department should be rated over a period of several weeks on the various jobs he or she performs. This can be called a productive or task rating. It is secured by dividing tasks performed by hours worked, or by dividing actual piecework earnings per hour by task earnings.*

If Jane Doe has ratings of 105 on job *A*, 106 on *B*, 102 on *C*, 87 on *D*, and 105 on *E*, her task rating should exclude the *D* rating, the piece rate on which is apparently low. Her rating will then be 104½. Job *D* should be studied from both motion and time standpoints, analyzed, and put correctly in line with other jobs. Of course, there always remains the possibility that job *D* is in line and that Jane Doe cannot master it. If so, she should be rated at 87 for *D* and 104½ for the other jobs.

Check Ratings Annually

Ratings should be checked at least annually to see whether operatives have improved, retrogressed, or simply maintained their skill. If there has been retrogression, it should be investigated to learn whether or not the operative was at fault. Poor health or nature of the work may be to blame; if so, immediate steps must be taken to remedy the cause.

The foreman must always bear in mind that more tasks mean lower cost per task, or in other words, more production makes for lower unit costs, indirect costs remaining equal. Therefore, it is up to each foreman to know his operatives' task ratings and step them up as fast as he can.

If after a trial period a new employee has received a task rating of 65 on a job where others are rated at 100 or better, and has been either unable or unwilling to boost it to 90 or better, the foreman should consider transferring this person to another type of job, and break in a new operative. This procedure should be repeated if necessary until one attains a satisfactory rating.

One might ask how a low-rated operative increases costs, so long as he gets what he earns. Well, if three operatives are required where only two highly rated ones would fill the bill, it means that three machines are required instead of two, more tools are required and more broken, and in some cases it may mean purchase of extra equipment if schedule requirements are to be met. In addition, the low-rated operative is generally discontented.

It goes without saying that a time study man or foreman should use caution in establishing a task to make sure that it is not too easy of fulfillment. We might expect a comparison of task and operative's task rating to show whether or not it is too easy, but this expectation is not always realized because some operatives hold back when their earnings reach a certain point. If this condition exists, it is usually betrayed by a task rating for the easy job that is met too consistently from day to day. All new jobs, therefore, should be given a temporary rate; later they should be reviewed, revised if necessary, and made permanent.

Once tasks have been established, permanent rates set, and task ratings worked up for each employee, the rates should not be cut, even though task ratings gradually increase as operatives become more proficient and motion-minded, because more tasks mean lower costs. Of course, an operation should be re-studied and re-rated when tools, processes, or materials are changed.

A change in rate should take into consideration only changed conditions, and not the operative's natural improvement in skill. If, for example, a part made from steel is to be made from brass in the future, only cutting time should be changed and not handling time, even though the latter is lower than that on the original study. Here, as always, the time study man is honor bound to be fair to operatives as they have no way of checking his studies.

Where employees work in groups, where output or tasks of one depend on another, it is difficult to rate individuals and the group accurately. Individuals should be interchanged occasionally between groups to see what effect changes have on the ratings. Where there is only one group, other means must be employed to root out poor operatives, because group ratings are only as high as that of the poorest worker.

From 84 to 110

It is important to get high-class performers in a group because the group rating increases as the individual ratings increase. A case in point—we had on a job a group of ten girls with task ratings of 84. By transferring one girl and realigning duties somewhat we stepped up output so that ratings jumped to 110.

When a cost-per-task bonus plan is in effect, the key men who share in the bonus soon discover that more tasks generally mean more bonus. They go so far as to do piecework themselves whenever the opportunity is presented, in order to create more tasks and reduce cost per task. They see that enough materials are always on hand, they coach slow operatives so that their task ratings can be improved.

*See "Cost per Task," August, 1935, page 339; "A Cost-per-Task Wage Plan," September, 1935, page 370.

Four Enemies of Lamp Efficiency

They are vibration, position, undervoltage and overvoltage. Any one of the four can make you pay more than you should for light

RALPH R. BRADY
Commercial Engineering Department
Westinghouse Lamp Company, Bloomfield, N. J.

LIFE and efficiency of Mazda incandescent lamps depend largely upon actual operating conditions. Under good conditions an incandescent lamp may be expected to have the life and efficiency for which it was designed. Making it operate under adverse conditions may, however, shorten filament life, or markedly reduce the efficiency.

In a new lamp the filament is "tough" enough to withstand rough handling. With use the filament undergoes a physical change that makes it more fragile. This increasing fragility does not mean that an incandescent lamp must always be handled with kid gloves, but merely that there are limits to the rough handling and vibration to which it can safely be subjected.

When lamps are used for general lighting service in locations subject to severe vibration, it is advisable to provide them with some sort of suspension device. Sometimes these devices take the form of spring sockets, socket adapters, semi-rigid hangers or, in very severe cases, spring-suspended hangers.

For local lighting, where the lamp and its reflector may be mounted directly on a machine and the use of vibration-absorbing devices is impracticable, it is recommended that lamps especially designed to withstand vibration be employed. The standard 50-watt, 115-volt lamp in a P-19 bulb is made especially for such service, and larger sizes are available. For extension cords subject to rough handling, as distinguished from vibration, the standard 50-watt, 115-volt, A-19 bulb, rough-service lamps or special larger sizes are recommended.

The efficiency of these types is, however, lower than that of standard lamps of the same wattage, and since they cost somewhat more (the price of more complex construction), their use should be restricted to severe-service locations.

Voltage is the electrical pressure at which lamps are burned. Nothing in lamp operation can equal the importance of maintaining the socket voltage as nearly as possible at the value marked on the lamp. Practically all matters that affect the efficiency and economy of a lighting system revolve around this requirement. Voltage is directly related to the efficiency and life of a lamp and, therefore, to the cost of light. Lamps are so designed that the cost of light is an economic balance between the cost of current and the cost of lamps. Burning them at an incorrect voltage upsets this economic balance.

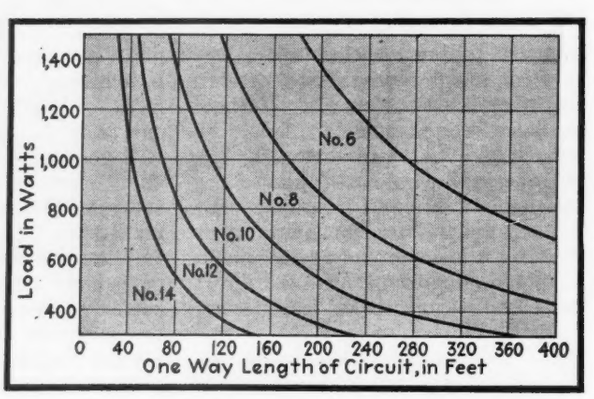
Save Current, Lose Light

When lamps are burned below the voltage indicated on the bulb the cost of light is increased. Although it is true that burning lamps at less than rated voltage results in an increase in lamp life and a decrease in current consumed, the loss in light output is so great in comparison as to cause the cost per unit of light to increase. Since it is light that is being purchased, these facts should be given serious consideration. The accompanying table shows the effect on the cost of light produced by under and overvoltage burning.

The following example will illustrate why undervoltage burning of lamps is unsound economically. Assume that a 200-watt, 115-volt lamp costing 55 cents is burned 5 per cent undervoltage, or at approximately 109 volts. What is the increased cost of light for 1,000 hours, with current costing 5 cents a kw.-hr.

Under normal operating conditions—rated voltage—the cost is:

0.2 (kw.) × 1,000 (hr.) × $.05	= $10.00
Lamp cost	= .55
Total cost	= $10.55



GIVEN the load in watts and the length of the circuit, the correct size of wire for a maximum drop of 2 volts at full load can be determined from this chart

At 5 per cent undervoltage the cost is:

0.2 × 0.925 (kw.) × 1,000 (hr.) × $.05	= $9.25
Lamp cost = $.55 × 0.50 (from table)	= .28
Total cost	$9.53

But less light has been obtained than under normal conditions. Therefore, it is necessary to multiply this cost by a ratio that will put both costs on the same light basis (3,400 lumens). This ratio is $1 \div 0.84 = 1.19$, and gives as the correct answer:

$$1.19 \times \$9.53 = \$11.34$$

The loss of $0.79 represents an increase of 7.5 per cent in the unit cost of light. From the standpoint of a single lamp it may seem small, but when many are burned it amounts to a considerable sum.

There are two general ways in which undervoltage burning can be avoided: First, use lamps of the proper voltage rating. Owing to carelessness or ignorance many lamps purchased are designed for a voltage different from that on which they are burned.

Sometimes lamps of a higher voltage rating are purchased because of complaints that the lamps do not last long enough. As was shown previously this is a short-sighted policy because in the long run it increases the cost of light. If lamp life actually is unduly short, the reasons for it should be ascertained and corrected, rather than adopt the wasteful expedient of using higher-voltage lamps.

Second, provide wiring of adequate size to deliver normal rated voltage at the socket. Voltage at the switchboard or substation may, probably will be, up to the proper value, but that does not solve the problem. Feeders should be sufficiently large to give a full-load voltage drop of not more than 2 per cent at the most distant socket.

Burning lamps at more than rated voltage is not so common as undervoltage burning. The table shows that overvoltage burning, within reasonable limits, is sound economically and results in a lower cost per unit of light. It is not recommended as a general rule, however, because it increases the frequency of lamp replacement. It is necessary to decide in each case whether the increased light output obtained justifies the more frequent lamp renewals. For some types of installations it is justified.

EFFECT OF VOLTAGE ON LAMP PERFORMANCE

Socket Voltage in Per Cent of Rated Lamp Voltage	Watts Consumed in Per Cent of Rated Watts	Lumens in Per Cent of Normal Output	Lamp Cost per 1,000 Hours in Per Cent of Normal	Unit Cost of Light* in Per Cent of Normal
90	85	70	24	116.8
92	88	75.5	33	113.0
94	91	81	44	109.2
95	92.5	84	50	107.5
96	94	87	59	105.6
98	97	93	77	102.6
100	100	100	100	100.0
102	103	107	130	97.6
104	106.5	114	168	96.0
105	108	118	191	95.2
106	109.5	122	215	94.7
108	113	129	278	94.0
110	116	137	344	93.8

*Applies only to 200-watt, 115-volt lamps at a list price of $.55 and energy at $.05 per kw.-hr. For other lamps and other energy rates the costs would be somewhat different

In lighting installations for athletic fields, for example, overvoltage burning has been almost universally adopted, the lamps being burned from 5 to 10 per cent overvoltage. In these cases the use of overvoltage increases the lumen output of the lamps and reduces the number of fixtures required for a given installation; consequently it cuts the initial cost of the equipment required. Since the actual hours use per year of such lighting installations is relatively small, the overhead charges are relatively high; so for this reason lamp cost as an operating item is subordinate.

Position Affects Life

Most incandescent lamps are of the general-service type and can be burned in any position. Their light output may not be so good, but with certain definite exceptions burning in any position will not result in any serious harm to the lamp itself.

In a gas-filled lamp, gas currents inside the bulb carry along the slowly evaporated black tungsten. If the lamp is burned base down, the tungsten particles will rise to the bowl of the bulb and form a black deposit that will absorb some of the light output throughout the remaining life of the lamp. If the lamp is burned base up, however, the tungsten particles will be deposited in the neck of the bulb and therefore reduce light output less seriously.

Some lamps are designed to be burned only in certain positions. In such cases incorrect position of burning may cause early failures as a result of the concentration of heat upon parts that are not designed to withstand it. Another result is damage to the filament, which may be unsupported in some directions.

Among the lamps whose burning position is restricted are those used in projectors. Such lamps are made with tubular bulbs so that when burned vertically they may be placed close to the lens and reflector system of the projector. The space for dissipation of heat is all above the filament. If these lamps are burned in a horizontal position, however, the heat cannot spread over a large area; therefore, when it is concentrated on one particular spot on the bulb, it softens the glass and causes early failure.

Upward flow of heated gas always produces a hot spot on the upper surface of the bulbs of gas-filled lamps. For this reason, they should not be used where they will be exposed to rain or snow. Sign and outdoor decorative lighting often come in this category. A 40-watt, gas-filled lamp gives off nearly the same amount of heat as a 40-watt vacuum-type lamp, but because this heat tends to be concentrated in one place a hot spot is produced which, upon contact with cold water or snow, may cause bulb breakage.

Keep Within Ratings

Manufacturers of lighting equipment usually cooperate with lamp manufacturers in the design of their product by providing sufficient ventilation or radiation to dissipate the heat generated by the lamps, and thus prevent excessive operating temperatures. These lighting units are usually rated in terms of the maximum lamp wattage for which they are designed. Use of lamps of higher wattage rating may cause failure of some part of the lighting unit or some part of the lamp. Therefore, the manufacturer's rating on any piece of lighting equipment should be observed.

Thinking of Burning Oil?

JAMES O. G. GIBBONS
Consulting Engineer, Bloomfield, N. J.

DURING the past decade the price of Bunker C, or No. 6 fuel oil has varied between $1.75 and $0.60 per barrel (42 gal.) at the refinery. These figures give an average, weighted with reference to time, of $1.19 cents a barrel. At present (April) the price is $1.05 per barrel, or 2.5 cents per gallon.

Whenever the price of heavy fuel oil reaches, or goes below its average value, those who are responsible for the production of heat and power in industrial plants face the question of whether oil is the cheapest fuel for the purpose.

Compare Costs per B.t.u

The delivered price of oil is, of course, dependent upon local conditions, but in the New York metropolitan district, provided there are reasonable facilities for delivery either by road or rail, the price will usually be in the neighborhood of 25 cents a barrel above refinery prices. Hence, the delivered price is now about $1.30 per barrel, or 3 cents a gallon.

Since the final decision regarding the type of fuel to be used often rests with executives who have had little personal experience with different classes of fuel, it may be helpful to outline some of the more important points that should receive attention when the advisability of substituting oil for coal is under consideration.

A good grade of bituminous coal will contain 14,000 to 14,500 B.t.u. (British thermal units, or units of heat) per pound. Sometimes it is economical to burn coal having a much lower heat content, because of the difference in price, but it should be borne in mind that the same freight rate has to be paid on the poorest coal as on the best. Other things being equal, it is the cost per B.t.u. rather than the cost per pound of coal, which should be the governing factor.

Heavy fuel oil, No. 6, usually contains between 18,500 and 19,000 B.t.u. per pound, and the average weight may be taken as 8 lb. per gallon. On the basis of 19,000 B.t.u. per pound, or 152,000 B.t.u. per gallon, 1 ton of coal containing 14,500 B.t.u. per pound, or 29,000,000 per ton (2,000 lb.) would equal about 190 gal. of oil which, at a price of 3 cents per gallon, would be equivalent to coal at $5.71 per ton, delivered.

Such a comparison is, however, far from being the whole story. When compared with the best stoker-fired or pulverized-coal operation the figures given above for the relative amounts of fuel burned will not be far wrong, but when the comparison is made with hand firing, or the use of poorer grades of coal, it may be found that the oil equivalent to a ton of coal may not exceed 130 gal. which would be equivalent to coal at $3.90 per ton.

Price of coal delivered to the plant does not include the cost of putting it into the furnace, and this cost may be considerable, whereas oil is pumped from the tank at small cost and there is no labor in handling.

When estimating what it will cost to burn oil the following points should receive consideration:

There is no solid, bulky material, such as coal and ashes, to be handled. A careful check-up on the amount of labor actually consumed in working around the coal pile and disposing of ashes, will often reveal that it is unexpectedly large.

Brains, Not Brawn

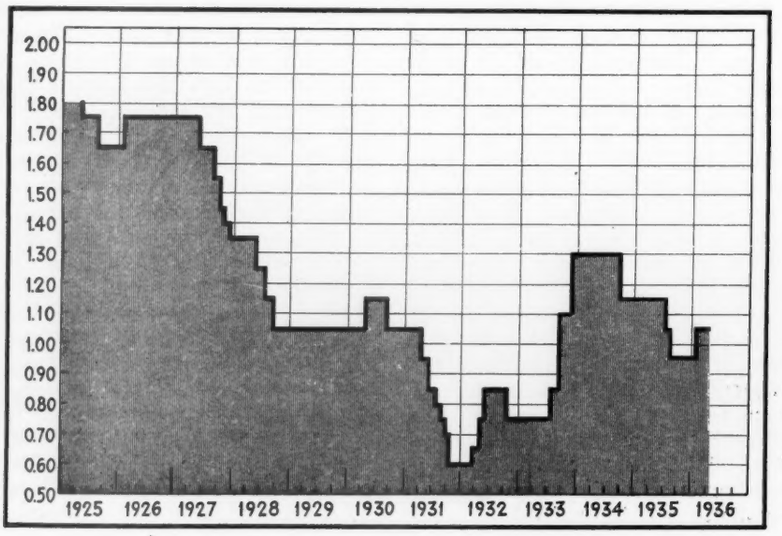
As a rule, the only moving parts in connection with oil burners, except those of the spinning-cup type, are the pumps. These are low in first cost and require only a small annual expenditure for maintenance.

The boiler room may be kept as clean as an engine room. One man can look after several boilers. It is a job that appeals to the better class of men because it calls for brains rather than brawn, although any man with reasonable experience and intelligence can soon learn to handle an oil-burning installation.

Where the boilers are operated less than 24 hours a day, there is considerable saving in banking costs, since no fuel need be consumed dur-

(Continued on advertising page 35)

Prices of Bunker C fuel oil, ex terminal, per barrel of 42 gallons



So Your Walls Leak!

Maybe you think so, but condensation and the presence of soluble salts are two conditions that may lead to wrong conclusions

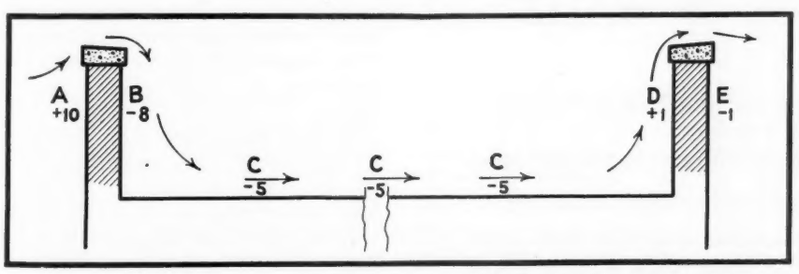
PERRY M. MOORE
President, Maintenance Engineering Company, Inc.
Bloomfield, N. J.

A PREVIOUS article (May, page 189) discussed some of the obvious causes for leakage of masonry walls and briefly outlined remedial measures.*

It is now in order to consider some of the other conditions that influence leakage. Why do certain walls of a building leak badly, whereas others do not? Why do buildings constructed of the same materials exhibit different behavior when situated in different locations? In short, what is the influence of atmospheric conditions, and how do simple physical and chemical reactions affect a wall?

It is commonly known that the flow of liquids through filter paper, filter cloth, or a masonry filter can be greatly increased by applying even a slight differential pressure. There is no such thing as 100 per cent perfect pointing on a masonry wall, and since transparent damp proofings are merely pore coatings which possess a critical pressure, and masonry is always somewhat porous with many cracks behind the exterior face after pointing, it is logical to assume that a wall can become in effect a huge suction filter when a differential exists in the static pressures on opposite sides of the wall.

Probably the most common illustration of this effect is found in parapet walls. The common conception that leakage of a windward parapet wall is caused by rain driving against it under pressure is only partially correct.



How wind blowing across parapet walls establishes difference in static pressure on the sides. The figures are arbitrary values, although their general relationship is supported by test data

Consider a large roof that is base-flashed, but not cap-flashed, into the brick parapet. Water striking the windward face of the windward parapet must travel through 12 in. of brickwork to reach the plaster on the ceiling below, and it does; water striking the windward face of the leeward parapet has only to travel past the base flashing to reach the plaster on the ceiling below, but it usually does *not* do so. Some other influence is obviously at work. It is differential static pressure.

The illustration will indicate in arbitrary figures the principle involved. Definite field data have substantiated the reasoning.

The windward face, *A*, has an assumed static pressure of +10, whereas the leeward face, *B*, has an assumed static pressure of —8, due to the venturi action of the wind, combined with the proximity of the roof. This gives a differential, relative static pressure of 18 across the windward wall.

As the wind passes along the roof line *C*, it produces a negative static pressure. Owing to this negative pressure, there is a much lower positive pressure, +1, on face *D* than on face *A*. Although venturi action also occurs on face *E*, it is obvious that free and rapid replacement can take place from the large volume of air below; so it is assumed that the static pressure on face *E* is —1. This gives us a differential relative static pressure of 2 across this wall.

Comparing the differential pressures across the two parapets, it is possible to arrive at a reasonable conclusion for the wide difference in action of the two walls.

The best practical step is to place an air seal across face *B*, so as to eliminate the negative static pressure on the inside face of the windward parapet.

In addition, proper treatment should include a definite and complete water cut-off across the top of the parapet, or through the parapet wall. Obviously, any remedial dampproofing on the face of the brickwork below the coping will merely tend to dam in any water entering above; so let us be sure that our starting point is invulnerable.

Treatment of Parapet Walls

Parapet wall treatments, therefore, fall roughly into the following general methods:

1. Where practicable, remove coping stone or tile and apply asphalt-saturated membrane in an asphalt trowel coat from the exterior edge of the parapet, across the top and rear, lapping over the cap-flashing. Air seal the cap flashing to base flashing with membrane and asphalt. Finish with mineral-surfaced roofing felt for appearance and sun protection. Re-lay the coping in the proper mortar bed. Calk the exterior bed joint of the coping with suitable calking compound.

2. With concrete copings cast in

*In presenting the material in this and the preceding article, the author makes grateful asknowledgment of the cooperation of Mr. C. C. Connor, Engineering Department, New Jersey Bell Telephone Company, who has collaborated with him in the study of waterproofing problems over a period of many years

place the treatment may be modified by using membrane and asphalt over the entire coping painting the exterior edge if desired.

3. Parapets that are of exceptional height or complicated by battlements so that treatments 1 and 2 are impracticable, can be made secure by placing suitable flashing through the wall above the roof flashing line and turning it down on the exterior face. This is quite expensive since successive pockets must be cut out of the wall and rebuilt step by step, joining the sections of flashing together. Under these circumstances waterproofing of the parapet above may be eliminated, unless desired from the standpoint of preservation.

No Need to Breathe

Parapet treatment is the starting point for subsequent dampproofing on the exterior face, and helps to solve the static pressure problem at this point. Many problems in waterproofing have been solved by parapet treatment alone.

It has been claimed that a parapet wall must be allowed to "breathe," and must be left open on the roof side. After ten years' experience with air-sealed parapets, I have yet to see disintegration in a parapet so treated. The chief cause for spalling of brickwork on the rear parapets is the formation of ice or the crystallization of soluble salts drawn to that face by differential static pressure, or because of faulty water cut-off above.

A building used for cigar manufacture exhibited no signs of leakage for years, in spite of severe exposure, cracked brickwork, badly efflorescing walls, and a number of missing coping stones. Recently, when the roofing was removed to repair the wood deck and install new roofing, the workmen had literally to lie on the felt to hold it down until nailed, because of the steady outrush of air from the building!

The large humidifying system drew thousands of cubic feet of air from outside and pumped it into the building in sufficient quantity to produce a continuous, positive static pressure. Therefore, all cracks and fissures in this building have a constant outward flow of air, and penetration by water has been successfully resisted in spite of the relatively poor condition of the structure.

The same principle is used in the construction of under-water tunnels, although considerably higher pressures are employed.

In the Door, Up the Stack

In another instance a stairwell penthouse showed excessive leakage on all walls, and when the door to the roof was opened there was a strong inrush of air, instead of the usual slight outward pressure from rising warm air. Investigation showed that the stairwell ran to the basement, adjacent to the boiler room. The stack exhausted large volumes of air from the building, and since the stairwell was the most accessible area from which to draw it, a negative static pressure was produced in the stairwell area, with resulting leakage.

Elevator shafts may produce a similar effect. Large exhaust fans, unless provided with an equalized intake into the building, may likewise produce a negative static pressure.

Therefore, the possible influence of differential static pressure should always be considered and, where possible, proper and easy equalization be provided.

Condensation Is Not Leakage

One familiar phenomenon, condensation, seems to be consistently overlooked, so far as building walls are concerned. If we consider a brick wall exposed to a temperature of zero at the exterior face and 70 deg. F. at the interior face, we must recognize that a temperature gradient exists in the brickwork and that condensation may take place on the interior face of the wall or at some point within the wall, depending upon the dewpoint temperature of the atmosphere.

A Canadian silk mill, kept at 80 per cent relative humidity, was recently compelled to install gutters and leaders on the interior walls merely because low winter temperatures brought the dewpoint temperature consistently at the interior face, resulting in a continuous flow of water.

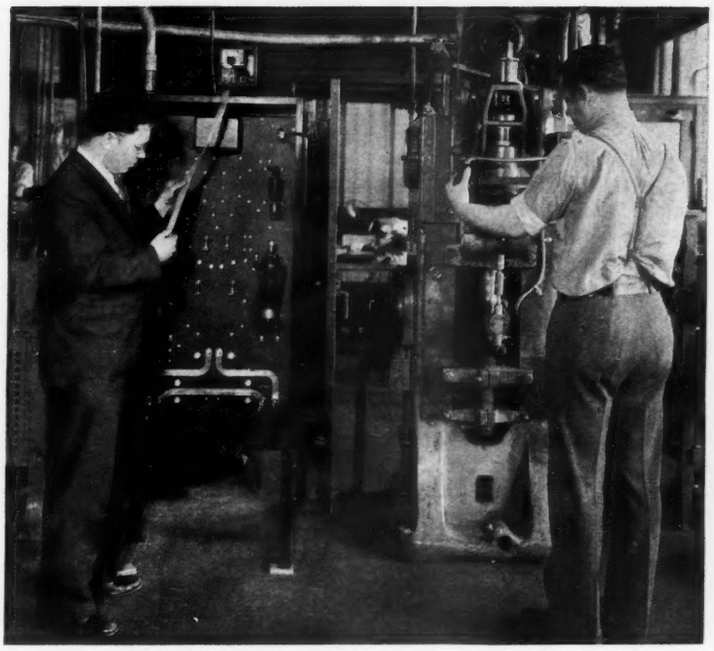
A few years ago we were asked to make good on a guarantee, since the plaster was wet on a wall we had waterproofed. Records showed that no rain had fallen for fourteen days; yet the plaster was saturated with water. A 1¼-in. hole was drilled from the interior side to a depth of 14 in. through the 16-in. wall. Only dry brick was encountered after the first half-inch at the interior face. The explanation is that the dewpoint had reached the plaster line and our guarantee meant nothing to the owner in the way of curing the plaster and paint problem.

Since that time careful observations have been made in this test hole and it can definitely be stated that the dewpoint line moves later-

(Continued on advertising page 37)

TO STOP LEAKAGE OF WALLS

1. When there are parapets:
   a. Be sure there is a complete water cut-off across the top or through the parapet, above the roofing.
   b. Establish an air seal from this cut-off point to the roof level.
2. Close all cracks on face of wall with plastic materials:
   a. Use calking compound where major movement may occur.
   b. Use plastic pointing compound where minor movement may occur.
3. Correct general porosity of vertical masonry faces with transparent waterproofing materials.
4. Study the relationships of exterior and interior sides of walls with reference to:
   a. Differential pressure.
   b. Atmospheric moisture and temperature.
5. Concentrate expenditures on proper treatment of the upper areas. It is rarely necessary to waterproof a wall from coping to grade.



CYCLE RECORDER, at top of panel, designed to check operation of welding machines, has found several other jobs

New Instruments for Industry

EVERETT S. LEE
General Engineering Laboratory
General Electric Company, Schenectady

LAST month the discussion on measuring devices that have within a few years been made available to industry closed with a brief description of the principles and apparatus used in sound measurement.

Closely allied is measurement of vibration. For the shop measurement of vibration the number of instruments on the market is legion. These are useful in trained hands. One of the illustrations shows a vibration velocity unit being applied to an electric motor. This unit can be used with a sound-level meter with an indicating instrument, as shown, or it may be coupled to a recording instrument to give a continuous and permanent record of the vibration velocity.

Such instruments have been found to be most useful in studying gear noises, and in factory control work to maintain the product within established limits. They are also used to measure transmission of vibration through holding bases, motor supports, and in construction work.

Another highly useful tool is the stroboscope, which operates by throwing light on machine parts at such a frequency that when the part moves at the same frequency it appears stationary. Slight non-uniformity in the motion of the part can thus be shown. These devices are largely for the use of the engineer, but they indirectly help the shop in the production of optimum designs and may sometimes be applied to shop problems.

Application of a variety of electrical instruments and methods to the detection of defects in materials and parts has been productive of useful results. There is, however, much more to be learned about this work, since the evaluation of quality is not always certain, due to the present lack of fundamental knowledge of the physics involved. The instruments that have been developed are, therefore, oftentimes empirical of application, and of rather high initial cost, although they give results of much practical value. If there were more appreciation of this situation, so that more such equipment might be purchased in more standardized form, the results would be beneficial to both the user and the supplier.

A number of useful devices employ magnetic means to detect defects. An instrument for detecting the percentage of iron in asbestos provides the basis for similar instruments for detecting broken needles in carpets, fabrics, and the like. By utilizing the change in magnetic permeability of a medium due to the presence of magnetic particles, equipment can be made for detecting such particles in candy, cellophane, non-magnetic scrap materials, sugar cane, and so on.

Instruments have been developed for the magnetic testing of welds in magnetic tubing, although here again the application is quite empirical, with the results certain within limits, uncertain outside these limits. Shown is equipment for detecting unbrazed portions in copper-brazed steel tubing. In this application a low frequency is used and the effect of imperfect brazing on the eddy currents produced in the tubing is measured.

Magnetic Flaw Detectors

Magnetic examination of large metal pieces, although costly, has proved to be of the greatest value. Use of a magnetic flaw detector on a turbine wheel, for example, reveals the presence of any hidden defect in the metal.

The one great obstacle to the wider use of defect detection equipment such as described seems to be the cost. Since the applications are special, the cost in lots of one or two can not very well be low. Technique up to our present knowledge

of physical laws is available for making these equipments. A better understanding of their possibilities and usefulness, together with a broad view of their cost, ought to lead to increased benefits through the production of better products.

Application of X-rays in the detection of defects has been most useful. Testing of welds for the Boulder Dam water tunnels was an outstanding example.

Timing

Instruments for timing operations cover a wide variety. Time meters available provide a simple means of checking machine performance to assure maximum use with a minimum of idle time.

The cycle recorder shown in one of the illustrations was designed primarily for timing welding machines, but may be used for other purposes. In many applications of welding it is important that the timing be exact, so that current will flow long enough to heat the metal, but not long enough to burn it. With an electronic, non-mechanical timer the ideal welding time may readily be obtained, and checked with the cycle recorder.

Other uses of cycle recorders include the timing of relays and the like.

A new electronic timer is available for applications requiring the direct measurement of time intervals as short as 0.002 second.

Oscillographs of various kinds are also available for timing. A portable oscillograph makes possible such shop applications as the testing of fuses where the time intervals are short. Records up to 30 in. long can be obtained to give time values on the order of hundredths of seconds.

Recording instruments are valuable in timing studies since they tell not only how much, but when.

In many shops there is need for the measurement of electrical resistance. Various kinds of measuring sets and bridges are available for this purpose. One portable, resistance-measuring instrument particularly adapted for low values of resistance is really a shop model of a Thomson double bridge, which can measure a maximum resistance of 22 ohms, minimum 0.0001 ohm, with an accuracy of 0.2 per cent.

The coil turn counter, too, is a highly useful device. A counter especially designed for shop use counts turns up to, say, 10,000 with an accuracy of 0.1 per cent. The interlinkage of flux per turn with a standard coil of a known number of turns is compared with that of the coil under test.

A late development is the phase rotation indicator for showing the correct connections when hooking up motors or circuits around the shop or in production work. When the line leads are connected to the binding posts of the device, phase rotation, as 1, 2, 3 or 3, 2, 1, is shown by lamps.

Light

Importance of adequate light in all workplaces is too well known to need much comment. The urgent need for some simple and accurate means of measuring the intensity of illumination has been met by the development of a self-contained instrument that reads directly in foot-candles. With it accurate measurement of intensity can be made at any place, in a moment.

It has been said, and truthfully, that practically any measurement can be made, at a price. Where shop instruments are generously used, the costs become low. Many useful applications have already been made. Many more will be made. Means, technique, and ability to extend them much farther are readily available.

COIL TURN COUNTERS hit it right within 10 turns in 10,000

MEASURING the vibration velocity of a motor is about as easy as reading a thermometer

A FLAW DETECTOR cross-examines a roll of steel tape to find out whether it is as good as it looks

Mechanical Power Drives

IN SELECTING the most suitable method of driving production machines it is a mistake to try to decide, as is sometimes done, whether group or individual drive is better. Neither is better for all conditions.

Closely allied is the mistake of trying to decide the type of drive most suitable for the plant as a unit. Study and decisions should be based on departments, sometimes on groups of machines. Conditions in different departments of a plant frequently differ so widely that blanket decisions are of doubtful value.

Correct answers to the following questions will frequently help in deciding where group and individual drives should be used:

1. What physical obstructions are there in the area to be served?— Necessity for overhead crane service makes the use of individual drive necessary. Similarly, conveyors or chains mounted overhead, and other obstructions, may interfere so seriously with group driving as to make the individual system preferable.

2. What is the concentration of machines in the area? — A large number of machines in a comparatively small area usually lend themselves well to group driving. On the other hand, when machines are widely scattered individual drive is preferable.

3. How much power do the individual machines require? — Machines that require, say, 20 hp. or more and that impose a fairly steady load are usually, although not always, best driven individually. When they constitute a highly intermittent load, with occasional very high peaks, it may be advisable to combine them in large groups.

When machines require up to a few horsepower, and particularly when their loads vary widely, group driving is preferable. When any machine is driven by its own motor the capacity of the latter must be large enough to handle the heaviest load that is likely to be imposed. Normally, however, the load will be considerably less than the peak value, with the result that the machine is considerably overmotored. This condition, in turn, results in low power factor and poor electrical efficiency.

4. Are there frequent changes in machine layout? — For machines whose location is changed more or less frequently, individual drive has definite advantages in the matter of cost and ease of making such changes over group-driven machines that require a countershaft. With machines that do not require a countershaft the cost of changing the location may be no more than the cost of moving an individually driven machine.

5. Do the machines require variations in speed?—Requirements for speed variation may or may not definitely indicate one or the other type of drive. With group drives variable-speed transmissions can be used if countershafts do not give a sufficiently wide range of speed variation, or if variation by steps does not meet requirements. The variable-speed devices may be arranged for manual, remote, or automatic control.

When machines are driven individually, multi-speed a.c. motors can be used to obtain two or four fixed speeds. Slipring or brush-shifting a.c. motors, shunt-wound d.c. motors, mechanical variable-speed transmissions, or a.c. squirrel-cage motors with inbuilt variable-speed transmissions may be used to obtain stepless speed variation. Choice of the most suitable scheme usually depends on local conditions, and will be influenced by comparative costs.

6. How will delays affect production schedules?—A certain amount of trouble with electrical equipment and mechanical power transmission devices is virtually inevitable, but it is difficult to evaluate the group and individual drive systems from the standpoint of the effect of probable trouble on production. Much depends on the manufacturing set-up.

Motors in the sizes used for group drives are rugged and long-lived. They are commonly mounted overhead and thus are not exposed to water, oil, and other foreign matter. When properly selected for the duty, they are usually not subjected to serious overloads.

Changes in power requirements of individual machines with minor changes in the product due to improvements and so on, tend to offset each other on the different machines in a group. Dull tools, oversize or tough stock, and machines that are stiff from recent overhauling seldom affect enough of the individual machines in a group to be of importance, although with identical machines working on identical products, abnormalities of raw material may be general in their effect.

Furthermore, an increased power demand on some machines in a group, due to changes in the design of the product, is frequently balanced by a decrease on others, or even more frequently by elimination of some operation.

When the Motor Fails

With ten to twenty or more machines in a group the cyclic variations in the power demands of the individual machines largely cancel out. The larger the group, the more complete this evening of the load becomes. These conditions favor trouble-free operation.

In a plant where corrosive fumes are absent and maintenance and inspection are well organized, there need not be more than one delay of an hour or more for each 100 group-drive motors installed. Some plants have operated for years with less than half that number of delays.

Small motors, on the other hand, are naturally less rugged. On individually driven machines they are frequently mounted close to the floor, or are exposed to oil, cutting compound, iron dust, and other harmful agents. Load fluctuations and overloads are more severe. Motors driving individual machines lack the protection against extreme load fluctuations afforded by the diversity inherent in a group of several machines. As a result, the number of failures per 100 motors in operation

(Continued from preceding page)

will be decidedly greater than in the case of group drive.

When a group-drive motor fails all of the machines in the group are shut down until the motor can be repaired or replaced. If this group of machines is making parts that go into stock before assembly the delay will probably not seriously affect the output of the plant. On the other hand, when parts go directly from machines to assembly a delay of more than a few minutes' duration is likely to tie up assembly and disrupt all schedules.

With individual drive, failure of the motor on one machine will have little effect on production if a number of machines are making the same part, or if sufficient stock is carried to tide the plant over an emergency. If the motor fails on the only machine that produces an important part the delay may be very serious.

Look Into Comparative Costs

In a large proportion of cases, however, answers to these questions will disclose no compelling reason why one type of drive is indicated, or should be chosen in preference to the other. The advantages and disadvantages of one about offset the advantages and disadvantages of the other. Choice between the two must then be made on the basis of other considerations, among which the comparative first and operating costs are the most important. These costs will vary for both group and individual drives according to the type of industry.

The average manufacturing plant operates a good-sized night shift in busy seasons or "good" years. In the depths of a depression it operates short-time with a reduced force. Over a period of years it averages somewhat less than single-shift operation at capacity output. For such a plant the first cost of all power transmission equipment, including electrical and mechanical items, will be almost twice as great for the individual drive layout as for group drive. More exactly, the cost will be approximately 80 per cent more when the average size of the individual motors is 5 hp. or thereabouts. If the average size of the motors is 1 or 2 hp., the excess cost will be close to 95 per cent.

For such a plant the total annual costs for individual drive are about one-third higher than for group drive. They will be somewhat more if the individual motor size averages only 1 or 2 horsepower.

When a plant belongs to a "feast or famine" industry, and therefore works night and day in some departments while it has no orders in others, and shuts down entirely in the dull season or a depression year, the first cost of the electrical and mechanical power transmission equipment will be from 2 to 2.2 times as great for individual drive as for group. Here again, the larger figure applies when the motors are small—say 1 to 2 hp. The lower figure will hold true when the motors average 4 to 10 hp.

In a plant that averages two shifts except for single-shift operation in a dull season of a few months, with three shifts in boom years and one shift in depressions, the initial investment in electrical and mechanical power transmission equipment will average about 80 per cent greater for individual drive than for group. The investment will be 10 per cent more if the average size of the motors is 1 to 2 hp., and correspondingly less when the motors are larger.

Annual costs for individual drive will be about 25 per cent greater for individual drive than for group drive; more if the motors average 1 to 2 hp., less if they average 5 to 10.

Lay Drives Out Properly

These cost relations as well as the inherent advantages and disadvantages of the two types of drives may, however, be seriously disturbed through failure to lay drives out properly.

With group drives avoid making the groups too large or too small; both conditions have disadvantages. Usually groups containing from eight to twenty machines are most satisfactory. The number of machines will depend on the length of lineshaft required and the load imposed by each machine.

Use of anti-friction bearings in group- and countershafts and in loose pulleys is advisable. They help to save power and oiling labor.

Avoid driving two or more parallel shafts by cross-belting; use a separate motor on each shaft.

Studies of losses due to pulley and belt windage show that these are larger than is commonly believed. Instead of the belt speeds of 4,000 to 5,000 f.p.m. that were formerly recommended and widely used it appears that the most desirable speeds are around 2,500 to 3,500 f.p.m. The exact value depends on such factors as the cost of power wasted and the capacity of the drive.

Liberal Design Saves Trouble

Advantages that accrue from the use of high-speed motors and the practical necessity of placing the motors fairly close to the lineshaft make it necessary to provide suitable means of maintaining proper tension in the motor belt. Two devices, the pivoted motor base and the idler, are available for this purpose and are widely used.

To minimize delays in replacing group motors in the event of failure they should always be located over a clear space beneath. Locating motors where they will be easily accessible also has the advantage of making inspection and maintenance easier, and therefore less likely to be neglected.

When individual drives are used it is advisable to mount the motors as high up as possible, so that they will be out of the way of falling material. If overhead mounting is not possible, consider the use of totally inclosed or inclosed, fan-cooled motors.

Motors can be connected to the driven machines in several different ways, and choice of the most suitable method must be based on local conditions and requirements.

Necessity of liberal design is one of the most important things to keep in mind when laying out individual drives. Stresses imposed while starting and during momentary peak loads will considerably exceed the rated capacity of the motor, and must be allowed for.

You want to know

and the editors will gladly tell you more about the things mentioned on this page

• SOCIAL SECURITY ACT—what it will mean to you. How it affects your personal insurance plans and investments, how it looks from business viewpoint, what chance it has before Supreme Court—told in a booklet. Has chart by which you estimate your profit or loss under the act. (6601)

• LIGHT is "stretched" by new lamp which changes invisible ultra-violet radiations into visible light. Fluorescence is the secret. Should find wide use in decorative lighting. (6602)

• METAL adhered by plastic cement to cardboard or other backing material gives metal-appearing product without metal volume and weight. Uses? Dress ornaments, signs, advertising specialties, display devices. Yes, it's flexible. (6603)

• HIGHWAY SAFETY you've heard a lot about recently. Ever stop to figure that a life lost is an economic loss as well as a personal one? It's estimated that each fatal automobile accident represents an average loss of $50,000 to the community. Better read "Industry's Part in Saving 38,000 Lives." (6604)

• ONE COMPANY with standardized buildings to sell has published a pamphlet telling how its product can be bought under FHA financing terms. Manufacturer arranges loan with approved lending institution. Don't forget FHA can insure loans for flood and tornado reconstruction. (6605)

• ADAPTER, popular-priced, transforms direct-light lamp lighting into indirect illumination. Screws into fixture after lamp has been removed, accommodates high-wattage lamps. (6606)

• MILK BOTTLES wear hats this year. Automatic machine puts cellophane hoods on any sized bottle at speeds up to 27 per minute. (6607)

• REFINEMENT on a self-curing plastic rubber cuts its shrinkage down to one-third of what it formerly was. Means longer life for the rubber, practical elimination of strains between coating and base surface. (6608)

• ARE you a centenarian, or do you hope to be? If so, you'll want to get one of those 200-year calendars. Just spin a wheel to find any date in the nineteenth or twentieth centuries. (6609)

• NO SOUND EFFECTS with a new bottle that pours without gurgling or splashing. Last drop's prerogative of running down the side is denied by a special overhanging lip. (6610)

• ACRYLOID is the name of a new plastic which has clear transparency, is tough, won't discolor. Comes by its name from the basic material, acrylic resin, a derivative of ethylene. (6611)

• ANY TROUBLE heating the office last winter? There's a new gas heater with blue mirror glass base, chrome metal trimmings, and fire-clay, heat-resistant diffusion units. All surfaces can be cleaned with soap and water. (6612)

• NO OLD BOTTLES for new wine. No old containers for new products. Styptic powder supersedes styptic pencil, appears in plastic box, shaker-topped. One dusts it on when cut. Hurts less, they say. (6613)

LET ME TELL YOU—it's a lot easier. This aluminum wheelbarrow weighs 40 lb. less than the ordinary 'barrow of its size. On this load of 4½ cu.ft. of coal I'm mighty glad to be rid of that 40 pounds. With that pneumatic tire, I can travel over rough ground without laying down planking. (6225)

• HEAT-RESISTING lacquer will withstand temperatures as high as 350 deg. F. Said not to smoke or give off odor. Remains hard after many periods of heating and cooling. Adheres to metal, protects against rust. (6614)

• REFRACTORY cement, castable, is suitable for lining walls of varnish pits, for doors, arches, walls, and floors of combustion chambers. Withstands temperatures up to 2,400 deg. F., is chemically neutral. (6615)

• PORCELAIN ENAMELING—booklet of one manufacturer shows how it's done. Illustrations and description of process. (6616)

• SYNTHETIC RESIN, soluble in alcohol, hydrocarbons, esters, and other commercial solvents, has permanent thermoplasticity, is free from wax, dirt, moisture. Melts at 95 deg. C., has color range 1 to 8, acid value of 5 or less, ash under 0.1 per cent. (6617)

• FOR AREAS where low cost and reasonable durability are demanded of floor covering there's a new one made of calendered mastic mix on tough saturated felt backing. Can be laid on concrete floors in direct contact with the ground. Four colors. (6618)

• WELDING is being used more and more in fabrication of aluminum products. There's a new book on the subject. And there's a companion volume on aluminum riveting. (6619)

• IF FOUR is your lucky number, you may be able to pick these cylinder and padlocks, but the manufacturer says you can't. They can be operated only by special four-sided keys; all purchasers are to be registered and duplicate keys supplied only to registered owners. (6620)

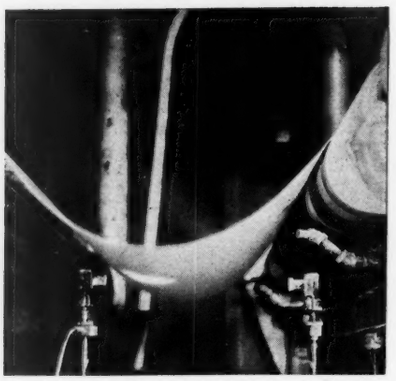
• MOTORISTS now set out flagmen when they make stops along the highway at night. Lantern operating on two dry cells flashes brilliant white light in one direction and intermittent red light in the other. (6621)

• COMBINATION of bulky, lightweight packages and conveyor sorting equipment is just the place to use a new dumping box truck. (6622)

• ORANGE OIL, of the synthetic variety, reproduces true fruit flavor, claims its maker. Manufacturers using citrus flavors should be interested. (6623)

• METAL AWNINGS of copper or aluminum permit full ventilation, diffuse but don't cut off light, can't rust. They fit against inside of window, are louver-like in appearance, operate by crank like automobile window. When not in use they fold almost out of sight. (6624)

Operating Shorts



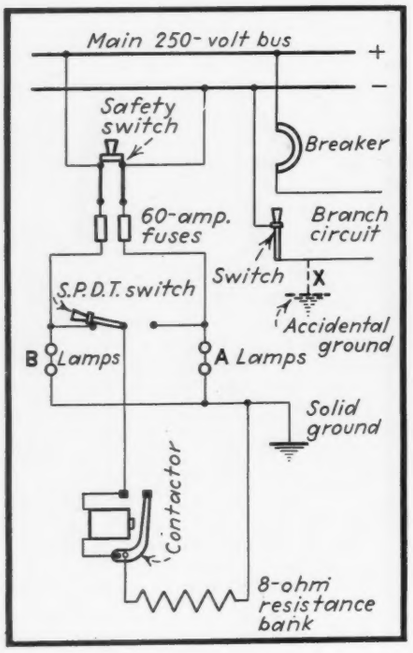
THE ELECTRIC EYE is quicker than the hand when it comes to keeping proper tension in the loop between the coating rolls and dryer section of a paper coating machine in a mill of the West Virginia Pulp and Paper Company. The Westinghouse photo-electric control speeds up the dryer motor when the loop becomes too long, slows the motor down when the loop gets too short

Locating Grounds on a D.C. System

JOHN J. TIMBERLAKE
The American Rolling Mill Company
Middletown, Ohio

A simple and effective means of locating accidental grounds on a d.c. system can be set up as shown in the sketch, at little expense. We use this scheme in our substation on a 2,000-amp. bus with four main branch circuits. An average of two grounds develop each week and we locate most of them in a half hour.

The contactor should be of sufficient capacity to operate continuously at 30 amp. without excessive burning of the tips. For circuits carrying less than 400 or 500 amp. a lighter contactor should be used, and a proportionately higher resistance bank substituted to limit the current.



The pick-up or exploring coil, which is connected to a pair of head phones, should contain several hundred turns of wire. If desired, an old field coil can be used.

In operation, if a fault occurs at *X*, say, the lights at *B* will burn brightly and those at *A* will go out. The double-throw, single-pole switch is thrown toward *B* and the contactor will rapidly open and close.

If the exploring coil is held within a foot or so of the grounded line the steady make and break of the contactor can easily be heard. As soon as the operator passes the ground, or goes off on a branch circuit, the clicking noise will cease.

Mr. Timberlake's contribution has been awarded the $10 payment offered by the editors for the best Operating Short submitted during the past month.

•

Employees Get Bonus for Length of Service

SOURCE, *E. F. Houghton & Company*
Philadelphia

All employees of this concern who have been two years or more in service were paid bonuses of $7.50 per year for every year of their connection with the company up to 10. The maximum of $100 per employee was paid to those having 15 or more years of service.

The bonus this year was 50 per cent larger than last, and 325 employees received it. Of the total number of employees at the company's three United States plants, 26 per cent have been employed from 10 to 20 years and 5 per cent for 20 years or more.

A Simple Device that Stopped Eye-Strain

F. W. SHUMARD, *Dean*
National School of Time Study
Norwalk, Conn.

Simple devices can often be used to alleviate eye-strain. There was, for instance, the girl operator who was constantly engaged winding white cloth tape about ½ in. wide on large flanged spools. Her work required careful visual attention to make sure that the layers of tape overlapped correctly on the rapidly revolving spool. Add to this the fact that she faced a white wall four feet in front of her and it is not surprising that she suffered headaches, with consequent loss of time and efficiency.

A small wooden screen painted green was placed immediately back of her work, shutting out the white wall from the line of vision. The green surface behind the white tape offered the proper contrast. Eye-strain ceased and with it the headaches. Efficiency naturally increased accordingly.

•

Company Name on Foremen's Shop Coats

WILLIAM C. BETZ, *Equipment Engineer*
Fafnir Bearing Company
New Britain, Conn.

In reference to William Peaslee's article in the December Operating Shorts, I believe that shop coats with

the firm's name on the back would be preferable to those with wearer's name, for they would have advertising value.

Coats should be made of serviceable, light-weight material, and designed for comfort. Color should also be considered.

I have a coat made of medium-blue, silk fabric, with the firm's name in red letters across the shoulders. This coat is light, launders well, and looks good.

From an advertising point of view —if the supervisors have occasion to go out into the reception halls, the expense of the coats is justified by the favorable impression they make.

•

Undersized Spacers Cause of Busbar Distortion

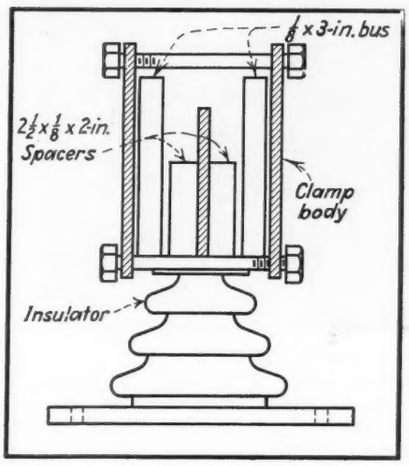
J. E. WRIGHT, *Montreal, Canada*

When spacers have to be used in order to hold a busbar rigid in the clamp, they should be the same depth as the bus and as long as the clamp body, or a trifle longer, to allow the bolts to pull evenly on the clamp.

The importance of this was shown recently when two $\frac{1}{8}$x3-in. copper buses were being installed. The clamp body was divided in the center by a $\frac{1}{4}$-in. separator. Buses occupied the space on both sides, a $2\frac{1}{2}$x$\frac{1}{8}$x2-in. spacer being inserted between the bus and the separator.

When the bolts were drawn up the body of the clamp was distorted, which in turn caused distortion of the buses so that they came in contact midway between the insulators, thus cutting down the air space.

These spacers were removed and new ones having the same depth as the bus and extending a trifle beyond the clamp body were substituted. Upon drawing up the bolts again the buses were held parallel between supports.



•

Radiators Go Round and Come Out Here

SOURCE: *De Soto Motor Corporation Detroit*

They're assembling radiator shells on a merry-go-round conveyor at De Soto. Sixteen little trucks that run on a track form a miniature assembly line on which the shell is built up as it makes the round trip. Each truck carries a complete assortment of nuts, bolts, etc. Storage bins handy to the line hold additional units. These radiator shells were previously assembled on individual benches.

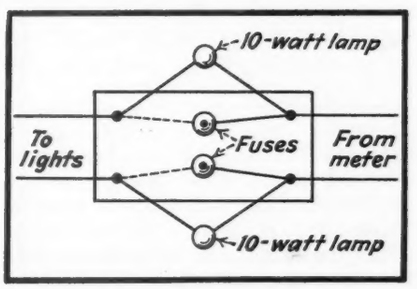
Tell-Tale Gives Light for Replacing Fuses

EMIL J. NOVAK, *Omaha, Neb.*

Where a number of circuits are on one main and the fuse blocks are placed in a dark corner, a blown fuse is difficult to locate without a flashlight. And that emergency aid usually has been mislaid and cannot be found when needed.

In order to provide a tell-tale to show which fuse is blown, and a light by which to replace it, the arrangement shown in the sketch was worked out. A socket was installed for each of the fuses that burns out frequently. Each socket was connected in parallel with its fuse, and fitted with a 10-watt lamp.

Such a small lamp will not affect the rating of the fuse to any extent,



and it will not glow until the fuse burns out. When the blown fuse has been replaced the lamp goes out.

•

Improper Ventilation Caused Generator Trouble

JAMES DIXON, *Construction Engineer Crocker-Wheeler Electric Mfg. Co. Ampere, N. J.*

After ten years' service in a meat packing plant a large, three-wire, d.c. generator broke down to ground. Rewinding of the armature was necessary.

No effort was made to determine the cause of the trouble, but for future protection the owner made a contract with an insurance company. Under this contract the rewound generator, guaranteed by the maker as equal to new, and all other motors and generators were to be tested periodically for insulation resistance.

After eleven months' service the insulation resistance of the generator again dropped below a safe value. Backing up his guarantee, the manufacturer of the generator examined it and ascribed the low insulation value to a deposit of black, greasy dirt on the windings.

At the same time, two smaller

Three sources of light are available to workers in this large drafting room which extends the entire length of the north side of the building. General lighting for dark days and evening hours in winter comes from 200-watt bulbs in semi-indirect fixtures. Local light on the work is provided by adjustable bracket lamps using 75-watt daylight bulbs

generators in the engine room showed no signs of trouble.

The machine was washed, using a high-pressure jet of carbon tetrachloride, dried, and varnished. This restored the insulation resistance to its original value.

Analysis of the deposit showed it to be composed of coal dust, ash, and packing house grease.

Six months later the insurance company again reported low insulation resistance. Another washing removed several quarts of greasy, black muck and restored the insulation resistance.

Investigation disclosed that there had been a change in plant conditions that should have improved them. A year before the generator broke down a ventilating system had been installed to remove ammonia fumes due to leakage from a refrigerating unit located near the generator.

The north end of the engine room faces on a vacant lot. The switchboard is at the north end, under a bank of windows that are always open. The south wall of the engine room separates it from the boiler room, and the generator is located near a large door between the two rooms that is usually kept open.

Before installation of the ventilating system fresh, clean air was drawn through the north windows. It flowed over the switchboard, south across the room, into the boiler room, and up the stack. The ventilating system fan, located at the north wall of the engine room, drew air from over the ice machine and the generator, and blew it out over the vacant lot. Actually, the fan drew air charged with coal dust out of the boiler room, and greasy air from the plant through the open doors. Passing over and through the generator the air left a considerable part of its dirt on the windings. A creepage path of low resistance from commutator risers to the armature core was soon formed.

The two small generators in the same room continued to receive ventilation from the windows over the switchboard and were never exposed to the dirty air; so their insulation resistance remained normal.

After the cause of the trouble had been found changes were made in the ventilating system to correct the bad conditions, and there has been no further difficulty.

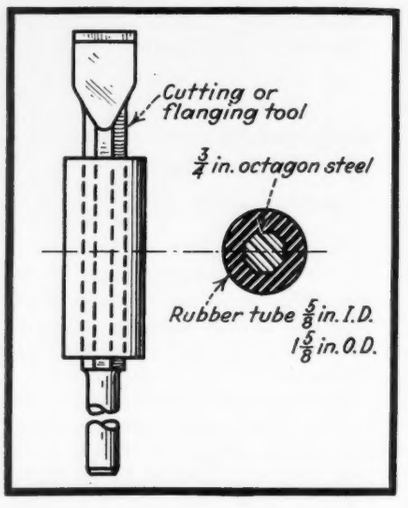
•

Rubber Handle Grip Absorbs Vibration of Air Tools

DANIEL D. EYSTER
Seaman Body Corporation, Milwaukee

Where air hammers are used for cutting and other operations, it has been found that the operators develop numb or "cold" fingers and wrists, due to the continuous vibration of the tool. In some industries, stonecutting especially, the ailment becomes quite serious. This is also true in automobile body plants, where metal flanging is a common operation.

We have found that by using a sponge rubber tube, cemented to the tool as a handhold, it is possible practically to eliminate such trouble. Inside diameter of the tube should be slightly less than the diameter of the handle, and a good grade of rubber cement should be applied to the tool handle before the tube is slipped on. The tube should be long enough to provide a good handhold, and be positioned so that it will best meet the operating requirements.



•

It Wasn't Overloaded, But It Stopped

ELTON STERRETT, *Longview, Tex.*

After months of satisfactory operation the 10-hp., three-phase motor driving an air compressor in an oil pumping station began to cut out 15 or 20 minutes after it was started.

Originally, high-pressure air was piped directly from the compressor into the well, but this resulted in surging which damaged the piping and overhead tank; so a surge tank was installed to reduce the effect of the pulsations. Three months to a day after this tank was installed trouble from stopping began, and grew steadily more frequent until it became a daily certainty.

This unit is located in a snugly constructed, 6x8-ft. "dog house" far from other equipment. Current is furnished by the local public service company.

The chief engineer repeatedly checked the compressor, and each time the electrician checked the wiring, motor, entrance switch and magnetic starting panel, without finding anything abnormal.

After each stoppage the temperature overload relay was found to have opened, simply requiring resetting. Most puzzling of all, as long as either the engineer or the electrician watched it the unit ran perfectly, only to stop again within a quarter of an hour.

A visiting electrician saw the installation and suggested a remedy. It was so simple that the men in charge laughed, but ran a test.

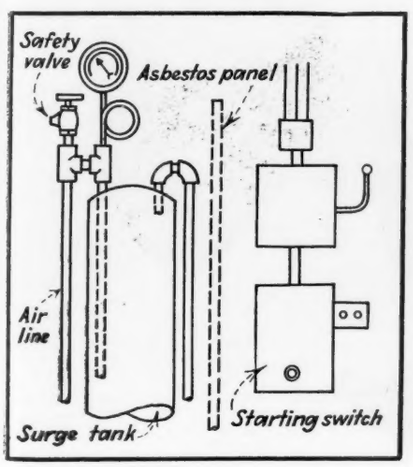
With the valve in the air line closed the unit was run to capacity, blowing off through the safety valve at 150-lb. pressure for an hour, and functioned properly. Then the visitor motioned the plant men inside the house, closed the door, and restarted the motor. Twelve minutes later the relay opened and the motor stopped.

Tank and compressor discharge line were sizzling hot and the starting switch, less than a foot from the tank, was too hot to be touched. Two more tests with the door closed gave the same results, proving the theory correct.

To shield the starter from direct radiation from the tank the asbestos partition shown in the sketch was set up and ventilating louvres cut in the wall behind the tank and starting equipment.

After these changes the unit ran perfectly. The reason why neither the chief engineer nor the electrician had located the trouble was because both, prevented by rules from smoking in the pump station, had enjoyed surreptitious smokes while watching the unit from the open doorway, thus permitting enough air circulation to keep the thermostatic relay cooled below the tripping temperature.

A check on the weather showed that the satisfactory initial run of three months was traceable to a cool spring, and that the trouble showed up with the first hot days of summer.

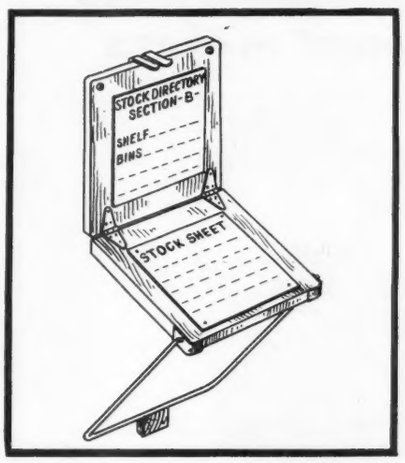


Folding Memo Desk Saves Aisle Space

C. H. WILLEY, *Concord, N. H.*

In stockrooms having narrow aisles, the folding wall memo desk shown will be found handy. It will serve to hold the daily or weekly stock report sheet, and to its wall face stock directory can be fastened. Both forms can be kept clean, since the desk is folded up after use.

The desk has a swinging supporting brace, is hinged, and is provided with a clip top to hold it closed.



To cut down outside-the-plant accidents and loss of trained workers some employers are extending to employees free automobile inspection service in company garages and repair shops. Brakes, tires, lights, steering gear, etc., can be checked at little cost.

SPECIAL NOTICE

$10 will be paid for the best Operating Short submitted during the month of June. The Editors are the judges. Other Shorts accepted will be paid for at attractive rates

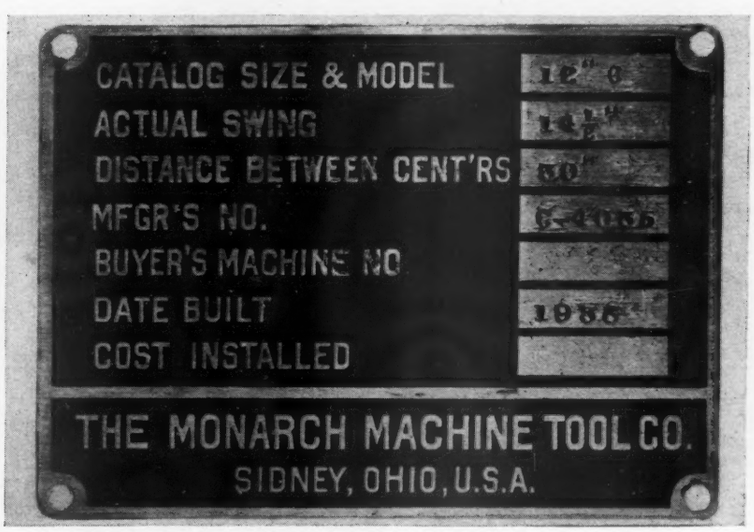
These Plates on Machines Made Men More Careful

SOURCE: *National Machine Tool Builders' Association*

By including a "cost installed" figure on machine plates great interest in and respect for the machines was aroused among operators and other workers in one plant. While the men had realized in a vague way that the machines and tools upon which they worked were costly, this innovation impressed them with the actual value. More careful operation and better workmanship resulted.

A sense of management's trust, in turning over operation and care of equipment representing such large investment, was aroused, and greater pride in jobs resulted.

Visitors to the plant were impressed and many asked for replicas of the plates.



1 Motor-driven roll-over device. Mathews Conveyor Company, Ellwood City, Pa.

2 Manifold-type air control valves. Hannifin Manufacturing Company, Chicago

6 Ampliset Free-Vane controllers. The Bristol Company, Waterbury, Conn.

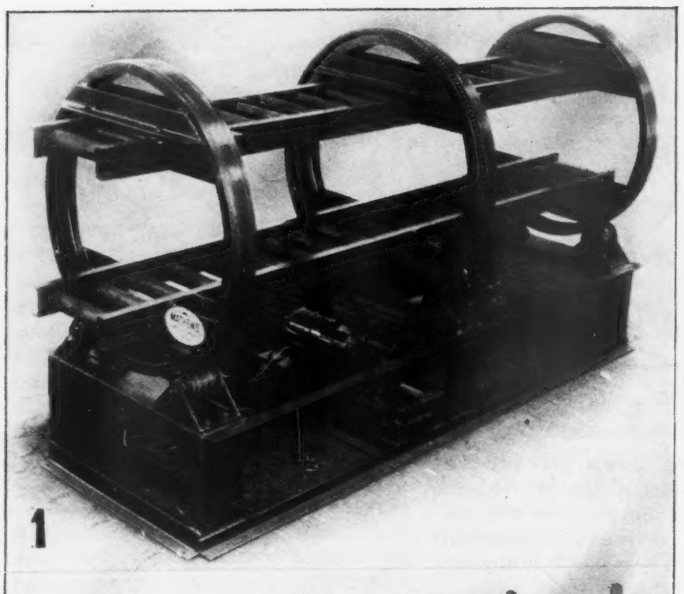
7 Type D switch. The Trumbull Electric Manufacturing Company, Plainville, Conn.

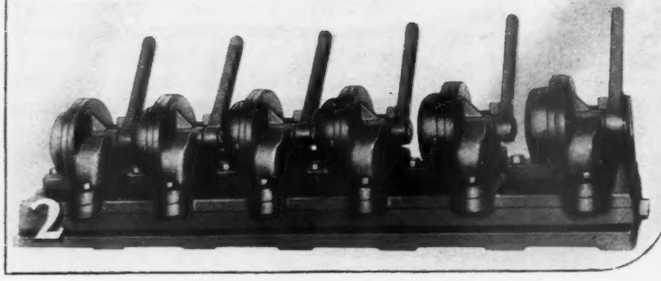
8 Multiple-circuit plugs and receptacles. The Pyle-National Company, Chicago

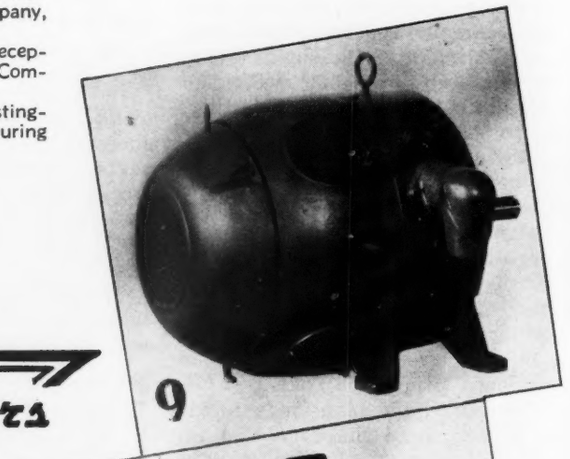
9 Type SK d.c. motor. Westinghouse Electric & Manufacturing Company, East Pittsburgh

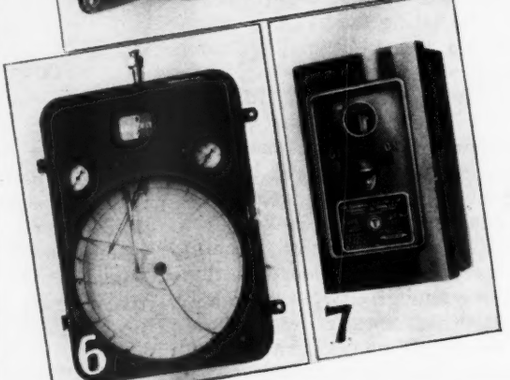
Flashes

from the equipment makers









3 Type ES-9 Pilot switch. Production Instrument Company, Chicago

4 Hydraulic lift truck. Lyon Iron Works, Greene, N. Y.

5 Model K tractor. Towmotor, Inc., Cleveland

What's NEW in Equipment

Air Conditioning, Ventilating, Heating

CONDITIONING UNIT—Model BA-100. Has telescopic duct adapter fitting under window sash to bring in outside air. Hand-operated damper. Dimensions: 45¾ in. high, 17¼ in. deep, 36-45 in. high. Operates on 110 or 220 volts a.c. York Ice Machinery Corp., York, Pa.

DUCT LINING—"Ozite" hair felt air duct lining and hair felt air duct insulation. Made from sterilized cattle hair. In two forms: felted with burlap backing and latex facing or sewn between two sheets of Kraft paper. Rolls in lengths up to 50 ft.; ½ and 1 in. thick; 3 and 6 ft. wide. American Hair & Felt Co., Merchandise Mart, Chicago.

INSULATION — "Inco No. 513 Sheet Metal Deadener." For sound and heat insulation. Flexible. Water and verminproof. Non-conductor of electricity. Inter-Coastal Paint Corp., 13th St. and Southern Railway, East St. Louis, Ill.

INSULATION — Sponge rubber insulation. Especially for cold lines in air conditioning and refrigeration. Tubing in inside diameters ranging ¼-⅜ in. Flat slabs ¼-1 in. thick. Miller Rubber Co., Inc., South High St., Akron, Ohio.

Ceramics

DRILLING MACHINE—"Portable Ceramic Drill." Has electric motor, drills in 9 sizes ranging ½-2 in.; also, adapter into which drill is inserted and abrasive powder and water are placed. Portable Appliances, Inc., Columbus, Ohio.

Communication and Signaling

SIGNALING EQUIPMENT—For use on steel mills between operator and inspector. Two transmitters, one at coiler and one at piler, and one receiver at operator's post. Signals set at one station are matched at the other. Westinghouse Electric & Mfg. Co., East Pittsburgh.

Electrical Control

CONTACTOR—Magnetic, front-connected contactor. Two-pole construction. Rated at 75 amp. Can be installed in cabinet 4¾ in. deep. Zenith Electric Co., 605 South Dearborn St., Chicago.

RELAYS—Line of d.c. photoelectric relays for operation on 115 and 230 volts. Units available with 2- and 3-in. lens apertures, with rectangular cell apertures and no lenses, and with no apertures. G-M Laboratories, Inc., 1731 Belmont Ave., Chicago.

RESISTORS— Type MW. Flat-wire-wound, heavy duty resistor strip inclosed in plastic casing. Units of 6 lengths ½-5 in. long have ratings of 6-20 watts at 100 deg. C. rise. International Resistance Co., Maule Bldg., Philadelphia.

SWITCH—Pressure switch for automatic opening and closing of electric circuits. For 2- and 3-wire systems and services up to 200 volts. Spencer Thermostat Co., Attleboro, Mass.

SWITCH — Type "D" front-operated switch. Two-pole and two-pole solid neutral, plug fused. Double break contacts; can be locked in "on" and "off" positions. The Trumbull Electric Mfg. Co., Plainville, Conn.

SWITCH—Type ES-9 pilot switch. Operates on ½-oz. pressure. In molded plastic case. Can be used for open or closed circuit operation. Can be adjusted for reciprocal or rotary switch motion. Production Instrument Co., 1325 South Wabash Ave., Chicago.

TRANSFORMERS—Line of audio transformers and reactors for all types of applications of electronic devices. "Super High Fidelity—Series A." Ferranti Electric, Inc., 130 West 42d St., New York.

VOLTAGE REGULATORS—Types GDA-1M and GDA-1. For a.c. machines up to 375 kva. at 3,600 r.p.m. Smaller ratings at correspondingly lower speeds. General Electric Co., Schenectady.

Electrical Distribution

CABLE COUPLERS—For high voltage applications, especially with G-E 2,500-, 3,500-, and 5,000-volt, Types SH and G portable cables. Four contacts: three for conductors, one for shielding braid or ground wires. Rated 100 amp. General Electric Co., Schenectady, N. Y.

SPLICE—For electric lines under heavy straight loads and under light twisting pulls. For wire sizes from No. 6 to 250,000 cir.mil. solid or stranded. "Straight-line." Reliable Electric Co., Carroll Ave., Chicago.

TERMINAL—Molded rubber terminal for terminating ground wires and braided shields so that they can be correctly grounded. General Electric Co., Schenectady, N. Y.

Electrical Protection Devices

FUSE—"Air Seal" fuse for use under oil in hazardous and corrosive areas. For 250- and 600-volt operation in standard sizes from 30 to 400 amp. Rowan Controller Co., Baltimore.

SURGE PROTECTION — Gaseous discharge tubes shunt out surges in d.c. circuits. Rated at 125, 250, and 500 volts. Two capacities: Junior line, 10 amp.; Heavy Duty line, 100 amp. Also arc suppressor consisting of surge protector tube and condenser. Sundt Engineering Co., 4238 Lincoln Ave., Chicago.

Filtering, Clarifying, Mixing

SIFTER — "Blutergess Turbine Sifter." Size No. 1. For sifting chemicals, clays, powders, food products. Sifts material of 6-350 mesh. Turbine mounted on vertical shaft throws particles at angle against vertical screen. One bag receives sifted material, another tailings. Motor mounted on stand with sifter. Abbe Engineering Co., 50 Church St., New York.

SIFTING MACHINE—Has rotary motion. Single and multiple screens. Ten sizes with sifting areas ranging 20-52 sq.ft. Sifting box can be divided to sift more than one material at one time. Box is dustproof. Motor sizes range ¾-2 hp. Sprout, Waldron & Co., Inc., Muncy, Pa.

Food

BUTTERFAT TESTER—Determines butterfat content of milk. Motor is directly connected to turntable to which individual bottle cups are attached. Base and bowl of cast iron. Removable top. Made in 12-bottle size for 6-in. test bottles. Creamery Package Mfg. Co., West Washington Blvd., Chicago.

Grinding and Buffing

BUFFER AND POLISHER — Selective-speed machine made in 6 sizes from 3 to 20 hp. Any spindle speed obtainable. Power transmitted by 4 V belts. Elevating screw can be used to raise or lower motor to maintain tension on belt. Standard Electrical Tool Co., West 8th St., Cincinnati.

FLEXIBLE-SHAFT MACHINE — No. 10-B. Bench type, set on swiveling tripod having rubber feet. Five-foot shaft covered with rubber and powered by 3-speed V-belt drive. Two sizes with many attachments. Wyzenbeck & Staff, Inc., 642 Washington Blvd., Chicago.

GLUE HEATER—Automatic electric glue heater to provide correct glue temperature for setting up polishing wheels. Pots inserted in holes in top are immersed in hot water in aluminum tank. Water is circulated around externally mounted heating element. Thermostat. Divine Bros. Co., Utica, N. Y.

GRINDERS—One and ¾-hp. grinders and buffers added to line. Single-phase, 3-phase, or d.c. motors. Toolrest can be set at any angle while using different sized wheels. With or without pedestals. Heavy guards. Marathon Electric Mfg. Corp., Wausau, Wis.

GRINDERS AND BUFFERS—One- and ¾-hp. grinders and buffers. In single-phase, 3-phase, and d.c. models. Heavy wheel guards. With or without pedestals. Marathon Electric Mfg. Co., Wausau, Wis.

Instruments and Meters

AMMETER—Safety tester for voltages above 600. Consists of ammeter mounted on aluminum casting and attached to insulated wood handle 5 ft. long. Insulated cord operates tongs contacting conductor. "Crompton Tong Test Ammeter." Columbia Electric Mfg. Co., Cleveland.

CONTROLLERS, RECORDING—"Ampliset Free-Vane Controllers." Pneumatic-type; for automatically controlling temperature, time-temperature, flow, liquid level, pressure, time-pressure, and humidity. The Bristol Co., Waterbury, Conn.

DIELECTRIC TESTER — Breakdown tester for indicating shorts, opens, or grounds, and for checking circuits at standard testing voltages. Secondary test voltages of 500-2,500. Can be plugged into 110-volt, 60-cycle line. The Acme Electric & Mfg. Co., 1448 Hamilton Ave., Cleveland.

INSULATION TESTER—"Junior Paragon Constant Pressure Megohmer." Differential-type measuring system. High torque; long scale. Bakelite case. Herman H. Sticht & Co., 27 Park Pl., New York.

OIL-FEED INDICATOR—For measuring flow from force-feed lubricator. Amount of discharge is shown by graduations on sight feed. Hills-McCanna Co., Nelson St., Chicago.

PYROMETERS—Indicating pyrometers. Model F has black bakelite case and Model C has chromium-finished case. Both models furnished in 4 scales: 0-600, 0-1,000, 0-2,000, and 0-2,500 deg. F. Thermo Control Devices, Inc., Milwaukee Ave., Chicago.

SOUND LEVEL INDICATOR—Measures sound levels as heard by the human ear. Has crystal-type microphone, amplifier, calibrated attenuators, decibel meter, headset. Range 30-90 decibels. A.c. or battery operation. Industrial Apparatus Co., North Wabash Ave., Chicago.

THERMOMETER, RECORDING—Small-bulb, gas-filled thermometer. For measuring temperatures between —60 and +1,000

deg. F. with tubing lengths as long as 100 ft. Compensating mechanism corrects for temperature changes along tube. Chart sizes: 12 and 8 in. The Bristol Co., Waterbury, Conn.

TIMING METER—"Tymeter." For time studies, tests, and production timing. Three models: one reads in seconds, one in seconds and tenths of seconds, one in minutes an hundredths of a minute. Has 110-volt, 60-cycle synchronous motor. M. J. Stillman Co., Inc., South Michigan Ave., Chicago.

VOLTMETER, RECORDING — Strip-chart moves at speed of 3 in. per hr. Range 0-150 volts. Magnetic damping and metal shielding. Types CD-23 and CD-24. General Electric Co., Schenectady.

Lighting

LIGHTING UNIT—Design 154 of "L'Or-Ray" series. Indirect luminaire using silvered bowl lamps. Hard glassine coating over aluminum. Two sizes covering 300-1,500-watt range. Curtis Lighting, Inc., 1123 West Jackson Blvd., Chicago.

Lubricants and Lubricating Devices

GREASE GUN—"Precision Electric Portable." Adjustable pressure up to 12,000 lb. Has 2-hp. motor, 19-plate storage battery, battery charger, pneumatic tires. Model S-35 has single 25-lb. grease container. Model D-35 has two containers. Precision Gear and Machine Co., Charlotte, N. C.

LUBRICANT—"Renite." For high temperature lubrication. Forms protective film over surfaces to which applied. Several grades. Renite Co., Columbus, Ohio.

LUBRICATOR — Operated by placing nozzle against cup or hole and pressing telescoping plunger. Oil pressure up to 1,000 lb. can be obtained manufacturer claims. Handles any grade of oil and liquid grease. In 11- and 17-oz. sizes. Morrow Mfg. Co., 1451 West Van Buren St., Chicago.

OIL—"Stanoil." Six grades of oil designed to cover entire range of industrial lubricating oils. Standard Oil Co. (Indiana), 910 South Michigan Ave., Chicago.

OIL CANS — Force feed oilers. Series 1100 is an engineer's and machinery-type can, lever operated. Series 1700, valve-in-spout type, is controlled by thumb lever. Series 1300 is a pump oiler, self-priming and operating in any position. Made of drawn steel. Gustave Lidseen, Inc., South Central Ave., Chicago.

Materials

RESIN—Thermoplastic resin. Melts at 95 deg. C. Soluble in commercial solvents. Neville Co., Neville Island, Pittsburgh

Materials Handling

BOTTLE FEEDER—Feeds empty bottles to filling machine. Cases of empty bottles are placed against filling table which tips over to horizontal position. Case is lifted off and bottles are pushed onto revolving disk which pushes bottles into mechanism that lines them up on conveyor. Horix Mfg. Co., Corliss Station, Pittsburgh.

FEEDER — Variable-speed feeder for finely powdered materials. Feeder is of cast aluminum and dust-tight. Driven by ½-hp., explosion-proof motor. Feeder speed ranges are 2-20 r.p.m. with maximum capacity of 121 cu.in. per revolution. Sprout, Waldron & Co., Muncy, Pa.

ROLL-OVER DEVICE — For revolving heavy objects through 180 degrees. Incorporates ball bearing roller conveyors. Travel is controlled by electrical limit switches. Ten seconds are required to revolve load 180 degrees. Mathews Conveyor Co., Ellwood City, Pa.

TRACTOR—Model K. Four-cylinder gasoline motor. Frame and bumper are one welded unit. Full spring suspension on both axles. Two forward speeds and one reverse. Length, 68 in.; height, 51 in. Can turn in 5-ft. radius. Towmotor, Inc., 1233 East 152d St., Cleveland.

TRUCK, LIFT—A 15-ton hydraulic lift truck. Has handle for pulling, and towing hitch for towing by power truck. Hydraulic rams, operated by hand hydraulic pump, elevate frame. Platform dimensions: 84x30 in.; elevates 3¾ in. Lyon Iron Works, Greene, N. Y.

TRUCK, LIFT — "Oneton." To lift loads operator simply pulls down handle. To lower load operator steps on release treadle, lowers handle. Capacity 2,000 lb. In 6-, 7-, 9-, and 11-in. heights, 18 or 24 in. wide. Barrett-Cravens Co., 3255 West 30th St., Chicago.

VIBRATING FEEDER — "Vibra-Flow Feeder Conveyor." For charging dryers, cookers, and furnaces with wet bulk material. Has stainless steel trough on vibrating base. Remote electric volume control. Syntron Co., Pittsburgh.

Mechanical Power Transmission

BELTING—"Beltpaco Junior." For fractional horsepower drives, light tensions, and small pulleys. New York Belting & Packing Co., 1 Market St., Passaic, N. J.

Metal Finishing

ANODE—"Wellcase." Lead anode for chromium plating. Wellman Bronze and Aluminum Co., Superior Ave., Cleveland.

CATHODE ROD — Brass and phosphor bronze rod for plating tanks. Manufacturer claims that it reduces loading and unloading time, requires no cleaning. J. Nelson and Son, North Wells St., Chicago.

METAL POLISH — For chromium plate, stainless steel, and aluminum. Said to give brilliant polish and not to slake. "New Cromex." Nickel & Chromium Products Co., 250 Park Ave., New York.

Metal Working

BURRING MACHINE — Removes burrs and flash from drop forgings. Hydraulic. Operating foot valve. Pump driven by 1½-hp. motor, cutter head by ¾-hp. geared motor. Capacity ⅜-3-in. hole and up to 3¼ in. in diameter flange. Crescent Machine & Tool Co., Rockford, Ill.

COIL WINDER—High-speed winding of wire with paper inter-leaving. Traverse guide is closely controlled as to length of travel and reversal of direction. Micrometer adjustments give fast clamping of winding arbor. Several sizes and styles. E. R. Seifert, Inc., Syracuse, N. Y.

DIE AND MOLD CUTTING MACHINES—For cutting dies and molds having ornamental designs and lettering by pantagraph method. Reproduction ratios ½-⅛ size of model. Cutter and tracer are always vertical. Two sizes: No. 3-B cutting 6x12-in. cavity, No. 3-L cutting, 9x18-in. George Gorton Machine Co., Racine, Wis.

DRIER — For steel sheets. For drying sheets that have been through a cleaning process after a period of storage. Air ducts throw streams of warm air onto both sides of sheets after they come from scrubber. Mathews Conveyor Co., Ellwood City, Pa.

DRILL — Production drill with back gear and direct-drive clutch interlocked and moved by one lever. Drills 3/16-2 in. can be used. Eight speeds from 65 to 1,350 r.p.m. V-belt drive. Buffalo Forge Co., 471 Broadway, Buffalo, N. Y.

DRILLING MACHINE — "Maxi-Gem." Has ½-hp. motor. Motor has sliding support. Flat belt connects motor and spindle. Spindle speeds of 1,000-12,000 r.p.m. Adolph Muehlmatt, Lyon Bldg., Cincinnati.

DRILLING AND MILLING MACHINE—Has stationary table, column, and column runway. Various table sizes and vertical travels of spindle head. Vernier scales reading to 0.001 in. Has 3- to 5-hp. reversible motor, either a.c. or d.c. V-belt drive. Eight feeds can be applied to every spindle speed. Entire control on head. Dreses Machine Tool Co., Cincinnati.

DRILLING AND TAPPING MACHINE—Has two No. 21 automatic drilling units mounted on vertical column, each driven by individual motor. One has 6-spindle multiple drillhead, other has 6-spindle multiple tapping head with reversing mechanism. Langelier Mfg. Co., Inc., Providence, R. I.

ELECTRIC DRILLS — Three models. "Special Duty" ¾-in., "Defender" ¼- and ⅜-in., "Model 40" special duty tool for light metals. "Defender" model has alloy steel helical gears in die cast aluminum alloy frames. Skilsaw, Inc., Elston Ave., Chicago.

FURNACE, BRAZING — "Firth Braze-Rite Furnace." Electrically operated; hydrogen atmosphere. Designed especially for tipping of sintered carbide cutting tools. Operates on 110-220 volts a.c. and d.c. Firth-Sterling Steel Co., McKeesport, Pa.

FURNACE, ELECTRIC—Working temperatures up to 2,750 deg. F. Manufacturer claims that heating elements are highly resistant to oxidation and can be used in reducing or oxidizing atmospheres. Duncan Mackenzie's Sons Co., Inc., Trenton, N. J.

GAS PRODUCER — "Atmosphere Gas Producer." Burns gas with predetermined quantity of air to produce non-oxidizing atmosphere for annealing furnaces. Capacity is 6,000 cu.ft. per hr. Automatic operation. C. M. Kemps Mfg. Co., Baltimore.

GEAR CHAMFERING MACHINE—Duplex gear chamfering machine. Hydraulically operated. Chamfers and burrs external gears up to 13 in. in diameter. Can chamfer two teeth simultaneously. Cimatool Co., Dayton, Ohio.

HOBBERS—Line of spline and pinion hobbers. Three sizes of diameter and pitch capacity. Can be furnished as spline and pinion hobbers, with or without differential, as thread millers only, or as combination of both. Driving wheel is of large diameter. George Scherr Co., Inc., 128 Lafayette St., New York.

LATHE—"W-20." Has multi-speed drive making possible changes of speed without stopping machine. Swing of 14 in. over entire bed. Bed is constructed of two heavy cold drawn seamless steel tubes. Tool rests are hardened. Bench or pedestal mounting. Yates-American Machine Co., Beloit, Wis.

METAL SPRAY GUN—Mogul Model A for spraying iron, monel, and steel; Model B for aluminum, nickel silver, bronzes. Single valve control. Lathe mounting. Wire feed and gas mechanisms are separately replaceable units. Can spray 11.5 lb. brass per hr. Metallizing Co. of America, Inc., Long Beach Ave., Los Angeles.

PUMP—Model 4R radial pump. Manufacturer claims that new design of relation between valve pintle and cylinder rotor makes possible high oil pressure with moderate oil leakage. The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

PUNCH PRESS—No. 4-1. Adjustable-stroke press for light punching. Stroke and table adjustable up to 10 in. Can be furnished plain or geared. Gear ratio is 1:6. Speed of plain press is 100 r.p.m. and motor is 1 hp. Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

RIVETER—"Hy-Power" hydraulic riveting machine. Has duplex hydraulic rams. Automatic electrically operated control valves. Foot-switch control button. Five-cycle operation. Can head ⅜-in. cold rivets. Has 2-hp. motor. Hannifin Mfg. Co., 621 South Kolmar Ave., Chicago.

THREAD GRINDER—Newall automatic universal thread grinder for precision threaded work. Pitch error controllable within 0.0001 in. In operation it takes light cuts at high speed. Driven by 2-speed a.c. motor. Twelve work speeds obtained from compounded belt cone. Two sizes. Reed-Prentice Corp., Worcester, Mass.

THREAD GRINDER—"Universal Precision Thread Grinder" with capacity for grinding external threads 8 in. in diameter,

NEW Equipment · Machinery · Materials · Supplies

24 in. long, on maximum length work piece of 33 in. between centers. Internal threads not smaller than 1 in. in diameter, 1 in. long, up to 8-in. diameter, 3 in. long can be ground. Automatic controls. Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit.

TUBE MARKER—Power marking machine for thin-walled, hollow metal parts. Parts are placed on pins protruding from revolving dial which carries them to marking die. Noble & Westbrook Mfg. Co., East Hartford, Conn.

TURRET PUNCH—Type R-5 heavy duty motor-driven turret punch with metal work table and graduated rear gage bar. Has 12 knockout dies. Any thickness of sheet steel up to No. 11 gage can be worked. Table dimensions are 39x23 in. Wiedemann Machine Co., Sedgley Ave., Philadelphia.

WIRE-FORMING MACHINE — "Multiplex." Automatic. Soft wire is fed from reel, straightened, cut to length, and formed with dies. Adjustments can be made while machine is operating. Capacity up to 10-gage and 21 in. in length. Economy Tool & Machine Co., Muskegon, Mich.

WIRE-STRAIGHTENING MACHINE—"Travel Cut." Flying-shear, automatic wire-straightening and cutting machine. Machine feeds wire from coil, straightens, gages to accurate length, and cuts on the fly. Five-die steel rotary straightener performs finish straightening operation. Lewis Machine Co., East 24th St., Cleveland.

Miscellaneous

BATTERY CHARGER—For truck batteries. Consists of motor, cooling fan, timing mechanism, copper oxide rectifier, mercury-tube switches. Automatic tapering off. Charging limit can be set by control handle. Three controls. Gould Storage Battery Corp., 400-450 Neoga St., Depew, N. Y.

CAST IRON FILLER — Cast iron filler for patching bad castings. Said to become very hard if applied correctly. "E-6." Porcelain Enamel & Mfg. Co., Eastern Ave., Baltimore.

CLEANING CHAIN — For cleaning drums. Case hardened steel links made with sharp edges and pointed ends. Vol-U-Meter Co., Inc., Ohio St., Buffalo, N. Y.

DRIER — Steam heated drier. Consists of rotary shell containing steam pipes placed near periphery. Through center is steam-jacketed mandrel to which are attached fins which raise material and drop it through the spaces between the pipes. Sizes: 18-28 ft. long, 62-102 in. in diameter. W. S. Tyler Co., Cleveland.

LABELING MACHINE—Imprints panels on lithographed cans. Has rubber dies used with "Litho" ink. Hand feed. Can be used on round or square cans of ½ pt. to 5 gal. Jas. H. Mathews Co., Pittsburgh.

MARKING MACHINE — "Model 25." Marks flat, round, or irregular surfaces. Table height can be varied through 12 in. Air pressure is used to bring work up to marking position. Die is mounted on slide with lever-operated stroke. Geo. T. Schmidt, Inc., Belleplain Ave., Chicago.

MELTING KETTLE—For heating tar, pitch, and asphalt. Oil burner is removable for use as torch. Two sizes: 25 and 15 gal. "Smokeless Patching Unit." Aeroil Burner Co., West New York, N. J.

PRESS — Model MPLS. For pressing glassware in block or open and shut molds. Air-operated and equipped with Tandem type pressing cylinder. Gear box has synchronizing mechanism making it possible to stop machine without stopping motor and feeder. Lynch Corp., Anderson, Ind.

PRIMER—"Special Primer." Applied to glass, metal, concrete, wood, plastic surfaces where it acts as an adhesive for a following coating of rubber. Self-Vulcanizing Rubber Co., 605 West Washington Blvd., Chicago.

PUMP — Chemical pump. Closed impellers. Pump ends can be made of special alloys. Deep stuffing boxes. Shell may be revolved to provide several positions of discharge. Buffalo Pumps, Inc., Buffalo, N. Y.

SAMPLERS—Bacon bomb samplers for sampling contents of tanks and tank cars. Model B traps liquid as it is lowered into tank. Model C is adjustable for depth and can take samples 1 ft. and less from bottom. R. P. Cargille, 118 Liberty St., New York.

STOOL—Metal stool. Frame consists of two main leg members notched and bent to form rest for wooden seat. Stretchers so riveted to form wedge lock and give 3-point contact. Pollard Bros. Mfg. Co., North Knox Ave., Chicago.

Motors

BALL MILL DRIVE—Motor drive for mills, rotary mixers, tumbling barrels. Built-in motor type with helical gears in reducing unit. Magnetic brake. Inching button makes possible moving mill short distances to gain exact loading position. Sizes 1-100 hp. Patterson Foundry & Machine Co., East Liverpool, Ohio.

D.C. MOTORS—Type SK. Fan-cooled, totally inclosed motors for 115, 230, and 550 volts d.c. Sizes 5 to 7 hp. Protection against entrance of splashing water. Only one cover must be removed to examine brushes or commutator. Westinghouse Electric & Mfg. Co., East Pittsburgh.

DRIVE—Two-motor, free-wheeling drive for centrifugals. Fast unloading. Main motor is direct-connected to spindle by flexible coupling. Unloading power is vertical, constant-speed gear motor. Free-wheeling device in one sheave mechanically disengages unloading drive when main motor runs. American Tool & Machine Co., 1415 Hyde Park Ave., Boston.

GEARED MOTOR REDUCER — Fractional horsepower motor of 1/45 to 1/30 hp. capacity. Gear reduction 1.6-150 r.p.m. Motor is a.c., 4-pole induction or 4-pole series wound for d.c. operation. Runs on 110 volts. Signal Electric Mfg. Co., Menominee, Mich.

GEARED MOTOR REDUCER—"Motoreducer." Any type of motor can be combined with reducer unit. Reducer housing provides base for motor. Resilient coupling. The Falk Corp., Milwaukee.

MOTOR—"Autosyn." Synchronous motor for use as transmitting motor in signal or control systems. Can be used with as many as 6 receiver motors. Operates on 115-volt, 60-cycle, single-phase line. Charles Cory Corp., 754 Lexington Ave., Brooklyn, N. Y.

VARIABLE-SPEED DRIVE — "Senco Vari-Speed Motor Drive." Speeds variable from 0 to 1,000 r.p.m. Has 1/100-hp., 110-volt, shaded-pole induction motor and friction disk clutch. Oilless bearings. Sundt Engineering Co., 4238 Lincoln Ave., Chicago.

Packaging

CARTON MATERIAL—"Protecto-Lite" board. Has black film between layers of boxboard to prevent passage of light. For packing materials likely to be affected by light. Interstate Folding Box Co., Middletown, Ohio.

LABELING MACHINE — "Vac-Spray." Operated by 1-hp., single-phase motor. Has compressor and spray gun which sprays labels with gum before they are pressed against container. White Labeling Machine Co., Second Ave. South, Minneapolis.

PACKAGING MACHINE—Packs materials that do not flow freely. Has motor and built-in gear reduction direct connected to packing auger. Electrically operated brake on motor. Containers holding 1 oz. to 12 lb. can be filled. J. L. Fergusson Co., Joliet, Ill.

STAPLER—For carton sealing. Staples flaps of corrugated or fiber container of overlap type. Paslode Co., 211-A North Bank Drive, Chicago.

Paint and Painting Equipment

BRUSH—Edging brush for black-edging white porcelain enameled ware. Movable metal guides to permit adjustment of width of brushing surface. Ferro Enamel Corp., Cleveland.

LACQUER—Elastic lacquer for use on rubber goods. Manufacturer claims that it can stretch as much as 200 per cent, that it will not discolor. Clear color. Stanley Chemical Co., East Berlin, Conn.

PAINT, ALUMINUM—"Alumikote." For interior or exterior use. Does not leave brush marks. Will stand temperatures up to 650 deg. F. Vita-Var Corp., Albert St., Newark, N. J.

PROTECTIVE PRIMER—For iron and steel. Penetrates and diffuses through rust. A blend of natural oils it drys into hard but elastic film in 48 hours. Forms bond between surface and exposure coats. The Flood Co., Cleveland.

SPRAY PAINTING EQUIPMENT—Consists of air compressor driven by ½-hp., single-phase, 110-volt motor, multiple-head spray gun. Copper expansion and cooling coil. Paasche Airbrush Co., 1901 Diversey Parkway, Chicago.

Piping, Valves and Fittings

STEAM TRAP—Type B. Inner assembly can be removed without breaking pipe connections. Seat and valve of stainless steel. In sizes ½-1¼ in. O. C. Keckley Co., West Washington Blvd., Chicago.

VALVE — Solenoid-controlled straight-way air valve. Rugged construction. Furnished for normally open or normally closed operation. Ross Operating Valve Co., Epworth Rd., Detroit.

VALVE—Style "H" hydraulic valves for oil or water service up to 5,000 lb. pressure. Steam and disk are connected by large-area bolt and act on principle of differential piston. W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa.

VALVE, TEMPERATURE CONTROL—"Series-T Thermo Valves." For controlling flow of refrigerant to evaporator in air conditioning or product cooling systems. Can be had for any specified degree of actuating superheat from 1 to 24 deg. F. Alco Valve Co., Big Bend Blvd., St. Louis.

VALVES — Packless manifold-type air control valves. For control of any number of air or hydraulic cylinders. Manifolds are 3- and 4-way types. Hannifin Mfg. Co., 621-630 South Kolmar Ave., Chicago.

Printing

CUTTER—C&P Bench Cutter. Cuts and trims sheets up to 19x24 in. Cutting table extends 24 in. back of knife and 11 in. in front. Cutting scale. Two-hand control. The Chandler & Price Co., Carnegie Ave., Cleveland.

DRYING RACK—Ten trays that fit press delivery. Trays are 5-ply wood. Composition rubber casters. Dimensions: 56 in. high, 22 in. wide, 30 or 34 in. long. Trays are 13½x20 in. for vertical presses, 17x22 in. for platens. C. F. Anderson & Co., South Calumet Ave., Chicago.

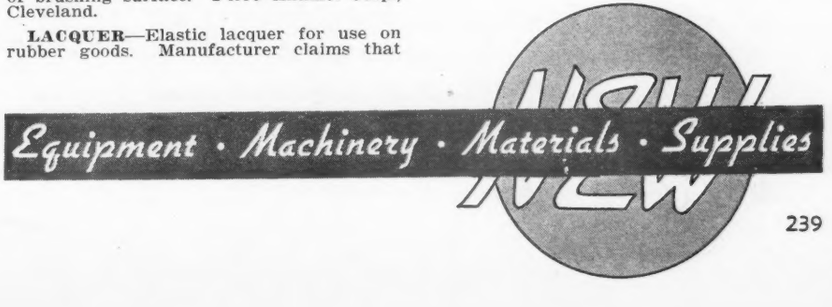
SHEET DRYER — Craig automatic gas heater dryer. For use on platen presses with automatic feed. Automatic start and shut-off control. Adjustable carburetor. American Type Founders Sales Corp., Elizabeth, N. J.

Power Plant Equipment

AIR COMPRESSOR—"Nu-Matic." Air is compressed by water under pressure. Consists of cylinder 8§ in. in diameter and 40 in. high with two chambers separated by check valve. Water forces air up into upper tank. Clayton Mfg. Co., Alhambra, Cal.

AIRCOOLER — For filtered compressed air. Has coiled seamless copper tubes inclosed in cast iron housing. Cooling water is passed through housing. Capacities: 40-300 cu.ft. per min. R. P. Adams Co., 220 Delaware Ave., Buffalo, N. Y.

DIESEL ENGINE—Two-cylinder, horizontal-opposed diesel engine. Develops 15



to 18 boiler horsepower at 500-3,500 r.p.m. Dimensions: 30 in. wide, 18 in. long, 18½ in. high. Covic Diesel Engine Co., Cotton Exchange Bldg., Los Angeles.

HOSE, COMPRESSED AIR — "Sterling Cord." Cords laid spirally in rubber. Inner tube is oil-resisting rubber compound. Cover resists abrasion. Lengths up to 500 ft. New York Belting & Packing Co., 1 Market St., Passaic, N. J.

INSULATING MATERIAL—"Super 66." For use on hot surfaces where temperature does not exceed 180 deg. F. Shipped in bags; mixed with water and applied with trowel. Eagle-Picher Sales Co., Temple Bar Bldg., Cincinnati.

PERISCOPE—For installation on boilers so that gage may be read from floor. Floor stand can be set with mirror 4-6 ft. above floor. Reliance Gauge Column Co., Carnegie Ave., Cleveland.

PUMP, CENTRIFUGAL—"Type SHB." For clear liquids. Capacity: 15-125 gal. per min. at heads of 10-40 ft. Maximum motor size is 1½ hp. Motor and pump shafts connected by flexible coupling. Yeomans Brothers Co., 1433 North Dayton St., Chicago.

STEAM SEPARATOR — For low level steam lines. Tested at 1,250 lb. hydrostatic pressure. Is 5½ ft. high, 20 in. in diameter. Can store condensed water from long line, giving trap time to operate. For 4- or 6-in. lines. Volz Engineering & Equipment Co., Cherry Ave., Long Beach, Cal.

Refrigeration

GAS PURGER — For ammonia systems. Purges ammonia system of air or other noncondensible gases. Seven sizes for suction lines from 1 to 4 in. in diameter. Creamery Package Mfg. Co., West Washington Blvd., Chicago.

MASK—Kit for protection of men servicing refrigeration jobs. Into rubber facepiece can be inserted different cartridges to meet conditions of ammonia, sulphur dioxide, or methyl chloride fumes. Chicago Eye Shield Co., 2331 Warren Blvd., Chicago.

REFRIGERANT LEAK DETECTOR — Detects leaks of chloride gases. Alcohol-burning blowtorch has special burner housing and flexible rubber tube. Air is drawn through tube and flame changes from blue to green if leak has occurred. Turner Brass Works, Sycamore, Ill.

Safety Equipment

HAIR NET — For girl operators. Of rayon with an elastic strand. In blue, red, black, three shades of brown. Industrial Products Co., North 8th St., Philadelphia.

LIFTING TOOL — Vacuum cup mounted on handle can be used to lift metal sheets from presses and piles. Pressure on trigger releases sheet. Industrial Products Co., North 8th St., Philadelphia.

RESPIRATOR—Hose mask with double outlet for 1- or 2-man use. Also, lightweight, half-hour oxygen apparatus with 2 types of mask: one has nosepiece only, other has complete facepiece. Mine Safety Appliances Co., Pittsburgh.

RESPIRATOR—No. R-150 chemical-cartridge respirator for protection against paint fumes, sulphur dioxide fumes, and smoke. Can be worn with goggles. Pulmosan Safety Equipment Corp., 176 Johnson St., Brooklyn, N. Y.

Textile

DRESSER REEL—Rindge-type. Cylinder with yarn supported around entire reel circumference. Designed to give more tension on warp. Built to hold long warps, and sections may be built up to 9 in. high. Davis & Furber Machine Co., North Andover, Mass.

OIL, SOLUBLE—For use in bleaching, dyeing, processing and washing. Has antiseptic properties. Leaves faint pine odor. "Pine Oil." Alex. C. Fergusson Co., Chestnut St., Philadelphia.

Tools and Supplies

BOLT — "Mechanical Rivet." Made of steel. Consists of bolt, nut, sleeve, and body. Body fits through hole in steel plate, sleeve is placed over it, and bolt inserted through center hole in body. Compressing nut is then put on. Multi-Seal Mfg. Co., 7755 North Sheridan Rd., Chicago.

EXTRACTOR—"Longrip." For extracting broken bolt, stud, and pipe ends. Vertical flutes groove their way when extractor is driven down into end to be removed. Ridge Tool Co., Elyria, Ohio.

FIRE POT—Has bronze burner made on principle of blowtorch. Flame control. Handle locks in vertical position for carrying. Can be used as blowtorch. Turner Brass Works, Sycamore, Ill.

HACKSAW BLADES—"Nu-Mol." General purpose blades for hand and power use. Standard sizes. Henry Disston & Sons, Inc., Philadelphia.

HAMMER — Has two rubber faces inserted in tapered shanks. Faces are 1¼ in. in diameter. Head is of cast iron, handle of wood. Dayton Insulating Molding Co., Dayton, Ohio.

MAGNIFYING GLASS—Has two lenses, magnifies 5 times. Molded plastic housing. Electric lamp operating from 110-volt line is fixed in handle. E. W. Pike & Co., Newark Ave., Elizabeth, N. J.

PACKING COMPOUND—Sheet material made of lead-tin-antimony-copper alloy. For high- or low-pressure applications. In sheet form or cut shapes. Lead Alloy Products Co., Walton St., Detroit.

PLIERS—"Thermo Grip." For applying or removing solder lugs and for making sweated joints in copper pipes. Transformer plugs into 110-volt a.c. line. Two-heat switch temperature control. Ideal Commutator Dresser Co., Sycamore, Ill.

SEALING COMPOUND—For producing tight joints in ceramic and terra cotta pipes. Produces tight joints immediately after application. "Tegul Mineralead." Atlas Mineral Products Co., Mertztown, Pa.

SOLDERING FLUX — Non-corrosive flux for soft-soldered joints. Active at soldering temperatures but at ordinary temperatures inert. Mann Instrument Corp., Cambridge, Mass.

TENSION INDICATOR — For measurement of tension on cable $\frac{3}{16}$ in. and smaller. Measures loads 10-200 lb. Automatic adjustment for temperature changes. Martin-Decker Corp., Long Beach, Cal.

TESTER, LAMP AND FUSE—For plug- or cartridge-type fuses and all types of lamps. Testing range up to 500 amp. Farmet Corp., 37 East 21st St., New York.

WHEEL DRESSER — Diamond wheel dresser with annular grooves separated by thin fins. Fins carry water close to the diamond and dissipate heat generated. F. F. Gilmore & Co., Dartmouth St., Boston.

WHEEL DRESSER — Trues polishing wheels prior to heading up. Dressing tool is abrasive stick 6x1x1 in. Transverse movement of tool is controlled by hand lever. Wheel spindle driven by 5-hp., 60-cycle motor for 110, 220, 440, or 550 volts. Divine Bros. Co., Utica, N. Y.

WHEEL PULLER—For taking wheels, gears, and the like from shafts. Two sets of jaws, one for internal pulling, one for external pulling. Sliding weight on shaft used to loosen wheel. Plomb Tool Co., Santa Fe Ave., Los Angeles.

Welding and Cutting

ELECTRODE—Coated electrode for use with small-capacity a.c. transformer welders. Four sizes: 3/32, ⅛, 5/32, and 3/16 in. "AC-Weld Electrode." Steel Sales Corp., West Adams St., Chicago.

ELECTRODE HOLDER — "Senior Duro Holder." All parts interchangeable. For heavy duty welding. Chuchward Engineering Co., New Haven. Conn.

HOSE—Rubber. For welding equipment and similar services. Connecting web joins two hose passages. Cord-wound reinforcement gives high burst limits. Individual hose in same or different colors. "Supero Siameez." Electric Hose & Rubber Co., Wilmington, Del.

TORCH — "Weldmaster." Torch with standard tip weighs only 17½ oz. Large tips may be used with low pressures. Spring-tension-equipped wheel handles assure permanent adjustments. Modern Engineering Co., St. Louis.

UNIT — Type 5SL. Includes torch, 4 tips, regulators, 2 lengths of hose. Tip sizes are Nos. 2, 4, 6, and 8. Torch will take up to No. 12 tip. Torchweld Equipment Co., West Lake St., Chicago.

WELDING TORCH—"Rego SX." Lightweight. Mixer sleeve and gooseneck made of aluminum alloy. Five copper tips for welding 24-gage to 5/16-in. steel. Bastian-Blessing Co., East Ontario St., Chicago.

Wire and Wiring Devices

FITTINGS—For use in operation of portable equipment. For circuits of 4-12 poles. Rated: 20 amp., 250 volts d.c., 460 volts a.c. Pyle-National Co., 1334 North Kostner Ave., Chicago.

FITTINGS — Four fittings for conduit grounding. Two have reversible shackles fitting 3 sizes of water pipe. One has connection for holding armored cable. Fourth item is fixture box. General Electric Co., Schenectady, N. Y.

GROUND CLAMPS — "Clamp-Tites." Two styles, for rod and pipe. Copper strap gives spring effect to assure positive grip. James R. Kearney Corp., St. Louis.

Woodworking

BANDSAWING MACHINE—Continuous-band filing, sawing, and emery machine in bench model. Operates at 140 ft. per min. and can take material up to 6 in. thick. Has built-in 1/3-hp. motor. Throat is 12 in. Continental Machine Specialties, Inc., Washington Ave. South, Minneapolis.

SANDER — No. 50. Automatic. Independent control of feed and spindle speeds. Self-adjusting sandipg rack. Variable speed of 10 to 30 pieces per minute. J. M. Nash Co., Milwaukee.

•

TRADE LITERATURE

Air Line Filters—Folder, describing Protectomotor air line filters.—Staynew Filter Corp., 25 Leighton Ave., Rochester, N. Y.

Aluminum Soldering—Folder, on Alumaweld solder and flux for soldering aluminum—Alumaweld Co. of America, 2442 South Park Way, Chicago.

Blowers — Bulletin 22-B12, on rotary positive blowers for foundry cupola service. — Roots - Connersville Blower Corp., Connersville, Ind.

Caster—Data Sheet, on Forgeweld truck caster.—Service Caster & Truck Co., 505 North Albion St., Albion, Mich.

Chain—Catalog Issue No. 7, containing data on welded and weldless chain.—Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

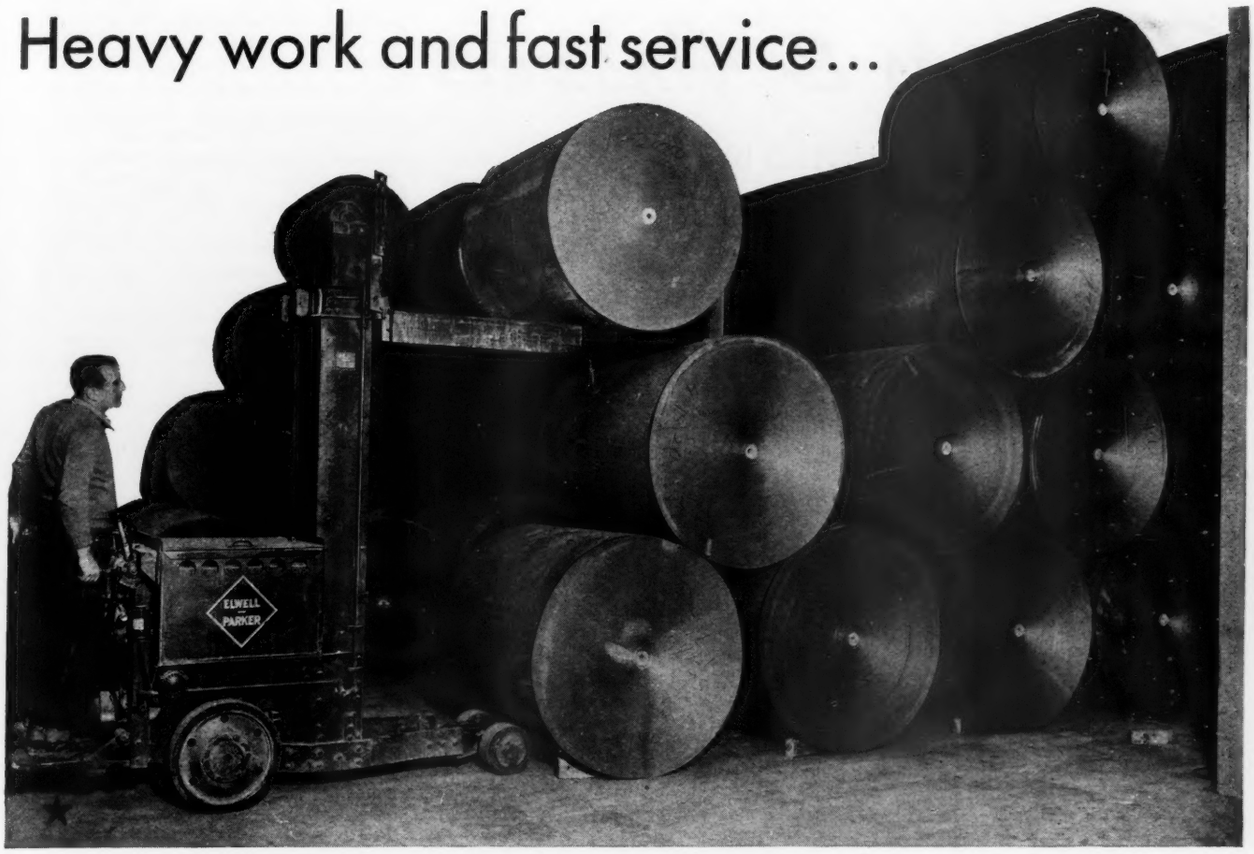
Condensate Return Units — Bulletin W-321-B6A, on Types D and G return units with single- and multi-stage centrifugal pumps.—Worthington Pump and Machinery Corp., Harrison, N. J.

Conveyors—Catalog 42, on Redler con-

(Continued on advertising page 42)

NEW Equipment · Machinery · Materials · Supplies

Heavy work and fast service...



...mean **EXIDE-IRONCLAD BATTERIES**

Exide
IRONCLAD
BATTERIES
WITH EXIDE MIPOR SEPARATORS

"MIPOR," Reg. U. S. Pat. Off.

★ Truck illustrated made by The Elwell Parker Electric Company

NO TIME can be lost, with modern production schedules. And when the work is heavy in addition, the equipment you use for material handling becomes of special importance.

No other method offers so many advantages as electric industrial trucks equipped with Exide-Ironclad Batteries. They have almost unlimited power when needed. There is minimum fire hazard. Because of the sustained voltage of Exide-Ironclads, you are assured of good speeds, without interruption, throughout the day.

Exide-Ironclads are unlike all other batteries. In their positive-plate construction, slotted rubber tubes retain the active material, while exposing it freely to the electrolyte. Separators are of Exide Mipor, the permanent storage battery plate insulator. Exide-Ironclads can improve your service and cut costs. Write for new, free booklet, "The Efficient, Economical Method of Handling Material."

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Questions & Answers

CONDUCTED BY

G. A. Van Brunt

Applying Block System Production Control to Typewriter Manufacture

I have read with much interest the articles you have published on production and inventory control. I use them regularly in my work as production engineer. Now I have received definite recommendations to use the block system of production control for typewriters and similar standard products. Unfortunately, I have had no direct experience with this type of control and should like to know more about it. At present a combination of stock limit and quota control is used. The former is applied to parts that are manufactured quickly and in small quantities. Quota control is used for parts that are produced continuously.

THE PRINCIPLE of the block system of control is comparatively simple. Apparently it was first used in the tailoring industry where orders for clothes (all to be made up in practically the same way) are grouped into blocks. Each block may consist of several or many orders, totalling a number of suits equal to the capacity of the shop for half a day, or some other unit of time. Since the product is basically standard, although it varies in details, it is obvious that the block of orders which will clear the first department should, if it suffers no accidents, pass without interruption to all subsequent departments.

Each department, including the preliminary clerical operations, is allowed a certain time for the completion of a block. It is received and signed for in a block from the receiving department, every order listed in the block being checked, and as soon as it is finished it is delivered in the same way to the next department. Reports of delivery from each department go to headquarters, and if any department is behind schedule immediate follow-up is possible to locate the cause of the trouble.

No block is cleared until all preceding blocks have been cleared and every order in the block has been delivered. This means that if any department holds out a single order for any reason, no succeeding department can clear a block until the impending block is put through. This situation puts great pressure on every department to keep the work moving, and maintain its record clear.

Special dispensations are, of course, made when serious trouble develops. The order may be taken out and listed in a later block, or it may be taken out entirely and handled by a special follow-up.

Basically, the block plan is most useful where a great variety of detailed orders must go through essentially the same steps in production. The plan is used by some of the large mail order houses and other concerns. It would be unworkable or offer little advantage in situations where this uniform flow of work through departments is not practicable. The blocks would break down, or so many exceptions would have to be made that little practical benefit would be derived.

In typewriter manufacture it would seem that a block system of control could be applied with advantage to packing, and shipping. It is doubtful whether it should be applied in place of the present stock limit and quota plans, for the assembly of parts. Also, there would probably be no special advantage in applying it to the assembly of large runs of standard-model typewriters, although it would be quite possible to put these in blocks, along with assorted blocks of small lots of special machines.

Generally speaking, the block system offers no advantages in large runs over quota production. It is useful mainly where numbers of small orders of the same general type are to be put through the plant. EDITOR.

How Remove Paints and Lacquers?

It is frequently necessary for us to remove paint and Duco or lacquers from metal parts. What are the fastest and cleanest methods of removing such finishes?

REMOVAL of paints, enamels, and lacquers from metal parts presents several different problems. Films of ordinary paints, japans, and varnish enamels are rapidly destroyed by strong, hot alkalis such as lye or caustic soda. When the part is made of iron, brass, or some other metal that is not attacked by strong alkalis the simplest way of removing the finishes mentioned above is to immerse the parts in such a solution. Immersion for a short time is usually sufficient to loosen the coating enough so that it can be flushed off by rinsing or with a hose. The parts may

Answers Wanted

How Determine Watts Loss in a Circuit?

I wish that readers would give me some information on the best methods of determining the power loss in some of our motor circuits. For example, on a three-phase, three-wire, 440-volt, 60-cycle circuit feeding about 400 induction motors ranging from 1 to 5 hp., these readings were taken, at the source: Kilowatts, 164; voltage between phases, 457; amperes, one phase, 365; resistance, 0.96 ohms. This figure was obtained by multiplying the single-phase resistance by 3. Can the power loss in watts in this circuit be calculated from these figures? If not, what is the best method of determining such losses? —S.S.

Isolating a Noisy Department

In one section of our plant a considerable amount of grinding is done, and automatic hammers are used for certain operations. Of course, it is very noisy and we are considering partitioning this section from the remainder of the shop. We should like to know what would be the best materials or kind of construction to use, in order to confine as much of the noise as possible in this department. —A.M.

Reconditioning Flooded Wiring

Have any readers had experience in reconditioning cables and wire that has been submerged in flood water? Recently a considerable amount of armored cable, some paper-insulated, lead-covered cable, and ordinary rubber-covered wire run in conduit was submerged for periods of a few hours to several days. To save time in restoring service, practically all of these conductors were replaced. We should like to put this cable and wire in condition for future use. Can it be done? How? —C.S G.

then be pickled or sandblasted, if desired.

Some metals, aluminum, for example, are attacked by alkalis; therefore, such agents must be used cautiously, if at all. I understand that some materials have been developed for removing paint and other finishes from these metals, and are on the market. In any event, ordinary varnish remover, which is composed of solvents that dissolve or soften paint films, but do not attack any metal, can safely be used.

Cellulose and synthetic resin lacquers are attacked very slowly, if at all, by hot alkaline solutions. Hence, the best way to remove such fims is to dissolve them off by washing the parts in the same thinner that is used to keep the lacquer at the desired consistency.

C. J. McDONALD, *New York*

Separating Foreign Material from Sawdust

In our woodworking plant sawdust and shavings are conveyed from a vault by a blower system which discharges into a cyclone dust collector. The waste then drops by gravity into a grinding or pulverizing machine which reduces it to a fine mesh. At times stone, glass, blocks of wood, nails, and iron get mixed with the sawdust. A magnet is used to remove iron and steel, and we should like to know whether there is any way to separate stones and other objects that are heavier than sawdust and might damage the grinding machine. It is important to remove any materials that could cause sparks that might result in fire.

The sawdust and shavings handled vary from 30 mesh to about 1-in. mesh and are light and flaky. Sometimes the blower will pick up small stones, but we cannot reduce the speed and still obtain the proper suction. Nor can the shavings be wetted. They come from kiln-dried lumber and must be kept dry.

If any readers have solved this problem we shall appreciate your giving us the details. —R.B.

SINCE the shavings and sawdust must not be wetted, it follows that any flotation method of separating them from foreign material cannot be employed. On the other hand, difference in weight is in this case the only factor on which a method of separation can be based. This points to the use of a light blast of air. Velocity of the air must be determined by test.

Presumably the cyclone dust collector is mounted on the roof, as is usual. With the grinder located at a low point in the plant, possibly in the basement, there will be a gravitational fall of some distance, which would permit introduction of the separating device.

I suggest that the wood waste be passed downward over a screen onto which blasts of air are directed. Instead of a series of nozzles directed onto the screen, a strong upward draft through the screen might be provided by a fan from a number of ducts. Upon encountering the blast of air the sawdust and shavings would be blown from the screen into a suitable chamber or duct through which it would flow to the grinder.

Foreign matter that is too heavy to be diverted from its course by the draft of air would continue on downward and into a pipe leading to a refuse bin.

Many details would, of course, have to be worked out, but I believe that this could be done by anyone who has had experience in laying out exhaust systems. JOHN E. HYLER, *Peoria, Ill.*

Increasing Speed and Horsepower of D. C. Motor

Is it possible to increase the horsepower output of a d.c. motor by rewinding it so as to increase the speed? For example, we have a 5-hp., 500 r.p.m., 230-volt, compound-wound motor which we want to speed up to 1,500 r.p.m., and raise the horsepower as much as possible. Can the speed of this motor be increased that much? If so, what is the maximum horsepower that could be obtained? —H.S.

A DIRECT answer to this question would require more information than is given about the mechanical con-

When We Need
Good Steel
Quickly
WE DEPEND ON
RYERSON
STEEL-SERVICE
S.A.E. Hot and Cold Rolled Alloys, Stainless, Tool Steel, Screw Stock, Shapes, Sheets, Plates, Bars, Welding Rod, etc., in stock for IMMEDIATE SHIPMENT.
JOSEPH T. RYERSON & SON, INC., CHICAGO
MILWAUKEE • ST. LOUIS • CINCINNATI • DETROIT
CLEVELAND • BUFFALO • BOSTON
PHILADELPHIA • JERSEY CITY

struction of the motor. Offhand, the answer would seem to be, No.

Just what increase in speed would be possible depends on the fundamental design, such as the frame details, size of shaft, mechanical construction of the armature, and so on. It is usually possible to operate a d.c. motor at twice the normal speed, on a test basis, but whether this can be done continuously is another matter.

Since horsepower is the product of speed times torque times a constant it can be seen that with an increase in speed the increase in horsepower will have to be limited to a value that will not impose too great a value of torque on the shaft. The speed, in turn, will have to be limited to a safe value to keep the centrifugal stresses on the armature, binding wires, and so on, to a safe value.

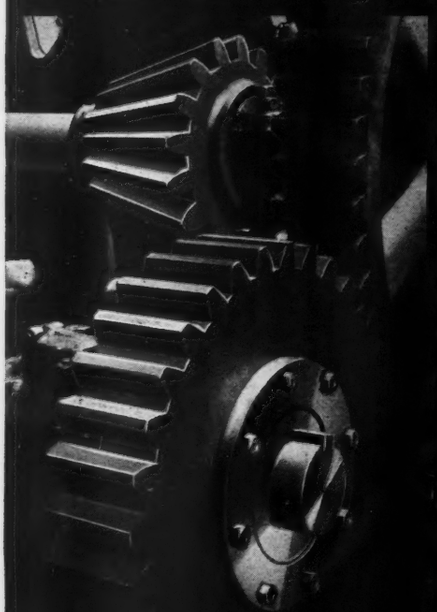
In my work many problems of a similar nature come up, and in each instance we find it necessary to consider all essential factors before a decision can be made.

The safest way to proceed is to obtain from the manufacturer of the motor all of the required information concerning the limiting factors of speed and mechanical strength.

C. O. VON DANNENBERG
Jamshedpur, India

INSUROK

Prevents Costly Production Delays



THE illustration at the left shows INSUROK bevel and spur pinions subjected to 24-hours per day continuous duty on a 132-inch board machine backdrive; hard, gruelling, destructive—the final and conclusive test of performance of any material.

When maintenance of production schedules is of vital importance; where unusual and difficult conditions are encountered; where demands are most exacting for wear and friction-resisting, dependable, trouble-free power transmission equipment, INSUROK gears and pinions are unmatched in performance—outlasting the materials they replace.

These advantages make INSUROK the logical choice for all your heavy driving equipment. Richardson engineers will welcome the opportunity to show you how INSUROK cuts costs by giving uninterrupted straight-line production.

The RICHARDSON COMPANY
FOUNDED 1858
Melrose Park, (Chicago) Ill. *Lockland, (Cincinnati) Ohio*
New Brunswick, N. J. *Indianapolis, Ind.*

Let's Tell the Employees

(Continued from editorial page 207)

•

a total cost that will leave a margin of profit sufficient to reimburse those whose confidence in the corporation caused them to advance the capital with which its operations were started.

With this policy of building and storing to even production and with an excellently developed manufacturing organization, Kelvinator is in a position to inform its employees the operating hours for weeks ahead. This permits workers to lay plans for their individual expenditures. For example, COLD CRAFT for October informed workers that:

For the second week in October we will run four days a week, eight hours a day. The third week in October we will continue with the same operations and operate eight hours a day five days a week. For the balance of October we will continue this same schedule.

Perhaps the greatest value growing out of the activities of the defunct automotive labor board was the recognition of seniority of worker service. The morale of Kelvinator workers is sustained by an article in the November issue:

Kelvinator employment departments are not hiring new employees into one plant while there are former employees waiting to be called back to work. Whenever it is necessary temporarily to reduce the force in a department, a complete list is made of every employee so released. The date of his first hiring, whether he is married or single, his occupation, and his rating of efficiency are carefully recorded. When it is time to call back a department, should there be shortages of any particular classification due to all the former employees in that classification having been brought back, or having found jobs elsewhere, careful investigation of other classifications is made to find men qualified to assume these new duties. Should none be available, then, and only then, will a new employee be considered.

COLD CRAFT is edited by a shop man for shop people, and consequently speaks in terms understood by productive workers, and talks about conditions important to them. Its content from month to month is a splendid example of how a management may build and sustain worker morale by supplying information concerning advance plans and policies affecting their daily lives. Enlightened management will increasingly use such means of developing a community of interest in the success of the business.

The Schoolhouse by the Mill

(Continued from editorial page 208)

shop training are required. A personal progress record is kept of each man enrolled. If he has made satisfactory progress at the end of the prescribed period, he is given a diploma by the Ohio State Board for Vocational Education.

If you were to ask our management to define the greatest single benefit derived from this school, they would tell you that it is the improved understanding of the economics of the business on the part of the organization. Before a man can be expected to put forth more than the minimum amount of effort required to hold his job, he must understand why that job exists, what he is supposed to do, how to do it.

He must look at the economics of the job; he must realize that his work is in direct competition with the work of others on similar jobs in competitors' plants; he must understand that good work contributes to the stability of his employment; he must realize that his ability to secure his proportion of the available work depends upon his ability to produce good work at the lowest cost possible.

Our superintendent uses a simple and understandable illustration to help each man see the part he plays in the chain of business operations. He points out that the salesman calling upon a customer has five things to offer—quality of product, service, price, his personal knowledge of the customer's problems, and the good-will he engenders. The man in the plant has direct control of the first three. The salesman can only promise; the man in the plant must deliver. Upon how well he performs his part depends the customer's satisfaction. When the man in the plant fails, some other company gets the order, and some other man will get the work and wages.

Thinking of Burning Oil?

(Continued from editorial page 224)

ing the shutdown period. The only loss is the heat radiated from the boiler itself.

With coal, especially when hand-fired, the efficiency may be very low because of unskillful operation, but any good, oil-burning boiler should maintain continuously an over-all efficiency of 75 per cent provided the load is fairly steady and the operator capable. In some instances a considerably higher operating efficiency can be maintained. With hand-fired, coal-burning boilers on the other hand, 65 per cent efficiency is good, and it depends to a large extent upon hard work, whereas with oil burning it depends largely upon the application of a reasonable amount of intelligence.

Although the installation of oil burners calls for an investment that is not required in connection with hand-fired, coal-burning boilers, it will usually be found that the amount compares very favorably with that required for stoker installations and is commonly considerably less when there are a number of boilers involved. The investment in oil tanks, pumps, heaters and so on, may be very little more for a number of boilers than it would be for one, whereas with stokers the number of units to be purchased is equal to the number of boilers to be equipped.

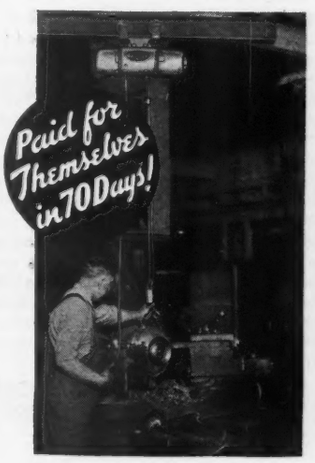
It will usually be found that the

THE POOR FELLOW'S TRYING!

IT'S no laughing matter if skilled machinists around *your* shop must tire themselves with back-breaking loads. And you won't laugh when you compare the fancy price you pay for back power with the lower costs and faster production you get with a P&H Zip-Lift. Here's a brand new way to cut your present handling costs.

Three Zip-Lifts serving three machine tools in this bay eliminated the need for steady crane service at a cost of $12.00 per day. Reducing time 5 minutes per lift on an average of 60 lifts per day, they saved $7.50 more or a total of $19.50 per day. These 3 Zip-Lift jib cranes bought themselves in 70 days!

Find out now about this new low cost method. Write today for new folder on "Spot Handling".



HARNISCHFEGER CORPORATION
ESTABLISHED 1884
4525 W. National Avenue, Milwaukee, Wis.

ZIP-LIFT

STOPS WASTE
WITH "SPOT HANDLING"

investment required for pulverized coal installations is much larger than that required for oil-burning equipment of equal capacity. Even with hand-fired boilers, a considerable investment in coal handling machinery and storage bins may be required.

There are, of course, advantages in favor of all fuels in general use, and the problem of deciding which class of fuel should be used in any particular case should be solved on its merits.

Again Gould leads the Parade

WITH EXTRA VALUES

Again Gould pioneers with the new Type KHD Armored Kathanode battery . . . giving extra capacity, extra dependability, extra long life, and extra economy.

Increased plate area gives the new Type KHD cell a conservative ampere hour rating 47% greater than the standard size. The ability of this battery to handle full capacity loads after years of service, *with new battery performance*, is explained by the five major exclusive features of Gould Armored Kathanode construction:

(1) GlassKlad spun glass retainer mats. (2) Durapor separators of silica gell and comminuted rubber. (3) Perforated rubber envelope armor. (4) New positive units. (5) New Ananide positive material. All combine to bring you amazing extra performance. Think what the increased capacity and advanced construction of the new Type KHD cells will mean on those tough jobs which are draining your present batteries to the danger point.

Send for the new Gould Battery Manual. It gives valuable information to help you increase battery efficiency and save money. Included are complete data on capacities, discharge rates, construction details, and latest methods of operation and maintenance. Mail the coupon *now*.

CUT YOUR BATTERY COSTS
FREE BOOK SHOWS HOW

Gould Storage Battery Corporation
400 to 450 Neoga Street
Depew, New York

Please send me free copy of your latest battery manual, No. 964, on the new Kathanode battery.

Name.....

Address.....

Time Study and Economic Balance

(Continued from editorial page 210)

analysis should be used in a general way. We do not try to go into complete detail for every single different piece we produce. For one thing, the accuracy of the estimated number of pieces would not justify it. But the time spent on this type of analysis as a general guide has been well worth while. Where more money is involved, as in the purchase of equipment, we are justified in going into more detail.

One class of problems in economic balance might be of interest—problems of inspection. It is customary in inspecting large number of pieces to use percentage inspection—that is, a sample of the lot is inspected, and if all pieces of the sample are satisfactory, or if there are less than a certain number of defects, the lot is passed. But, when more than the acceptable number of defects is present in the sample, should the lot be rejected, or should the whole lot be inspected piece by piece?

With small parts it often costs less to scrap than to inspect the whole lot. It depends upon the value of the part and the cost of inspection. The reasoning is this: A certain amount has been spent to produce the part up to the time the defect is discovered. A good part has a certain value—the normal cost of producing that part up to this point. It will cost a certain amount over the normal inspection cost to sort the good from the bad. Will this extra inspection cost be less than the value of the good parts obtained? If so, sorting will pay.

In other cases we may normally have 100 per cent inspection, but a particular lot may run with such an abnormally high proportion of rejects that it does not pay to make the inspection. In the first case, let

C_1 = cost of producing the part up to the inspection
C_2 = cost of inspection
r = proportion of good work (ratio of good to total)
N = total number to be inspected
P = normal proportion of lot inspected

Then $r\,N(C_1 + PC_2)$ = normal value of good parts from lot, and
$NC_2\,(1 - P)$ = extra cost of inspection.

When the value of good parts is equal to extra inspection cost, we have the equation

$$r\,N\,(C_1 + PC_2) = NC_2\,(1 - P)$$

$$r = \frac{C_2\,(1 - P)}{C_1 + PC_2}$$

When the proportion of good parts is less than r, the lot should be scrapped.

In the second case, when we should normally have 100 per cent inspection for the particular part, the cost of inspection is NC_2.

Let g = proportion of total that would normally be good. Then the total value of good pieces after the inspection would be $\frac{C_1 + C_2}{g}$, and the total value of pieces from the lot would be $r\,N\frac{(C_1 + C_2)}{g}$. When these are equal,

$NC_2 = r\,N\,(C_1 + C_2)$, and $r = \frac{gC_2}{C_1 + C_2}$.

The factor g may be equal to one in some cases. However, the reason for having 100 per cent inspection often is that the normal proportion of rejects is so high that a percentage inspection is not satisfactory. Hence, in 100 per cent inspections the factor g must usually be considered.

The same reasoning can be applied to repairs—that is, to determine whether defective work should be repaired or scrapped.

Finally, let us consider work that must be performed on a certain proportion of the parts in a lot—for example, straightening operations that may result from distortion in hardening or other causes beyond our control. The whole lot may be sent to the straightening operation, and the operator will go through the movements on each piece; or the work may be sorted, and the operator will be paid only for the work that requires the operation. At what point is it advisable to pay for the operation on each piece rather than to inspect and sort?

Let R_1 = hourly rate for inspection
R_2 = hourly rate for straightening
K = proportion of good work in total lot
S_1 = standard in pieces per hour for inspection
S_2 = standard in pieces per hour for straightening
N = total number of pieces in lot.

The cost of straightening all the good pieces in a lot is $\frac{NKR_2}{S_2}$, and the cost of inspecting the lot is $\frac{NR_1}{S_1}$.

When these two are equal,

$$\frac{NKR_2}{S_2} = \frac{NR_1}{S_1};\ \text{or,}\ K = \frac{R_1S_2}{R_2S_1}$$

Since $\frac{R_1}{R_2}$ is a constant for any one plant (or class of work) we shall designate this ratio as C, and we then have the formula $K = C\frac{S_2}{S_1}$. When the proportion of pieces requiring straightening is greater than K, the whole lot should be straightened; when it is less, the whole lot should be sorted. The same analysis can be applied to any other operations that must be performed on part of a lot.

These formulas are simple enough so that they may be readily used by the inspection supervisors. It is essential that formulas used in manufacturing should be simple. The more generally they are used throughout a plant, the simpler they should be. Usually the people who use them are not mathematicians. Executives tend to regard involved formulas as academic and impractical. Some formulas involving good ideas have been killed because they were too complicated. Formulas for general use should not call for data not readily available. It is better to make a reasonable approximation that is simple than to use a complex formula that considers all possible refinements.

•

So Your Walls Leak!

(Continued from editorial page 226)

•

ally through the wall under varying conditions.

Moisture reaches the dewpoint line in the form of vapor and will pass through every type of organic film—rubber, asphalt, paraffin, cellophane, or paint—that has been tested. Furthermore, moisture precipitates out as long as the proper conditions exist.

In recent tests a room 270 ft. long, 50 ft. wide, and 12 ft. high was dehumidified continuously to a relative humidity of 0.2 to 0.5 per cent, with all fissures carefully sealed. Moisture came through the 13-in. brick walls at the rate of 1 qt. of water an hour.

It is obvious that a building wall must handle moisture and be capable of retaining it without interior damage until favorable psychrometric conditions cause absorption by the atmosphere. The effect of raising the interior relative humidity by artificial means, or by the

DEVILBISS
New Type MBC
SPRAY GUN

● These advanced features mean efficiency, speed and economy for thousands of users

1. Graduated Spray Width Adjustment
2. Fluid Flow Adjustment
3. Removable Spray Head
4. Ball and Cone Principle of Nozzle Parts Assembly
5. Cartridge Type Fluid Needle Adjustment Assembly
6. Stainless Steel Fluid Needle
7. Large Air Passage
8. Air Connection with a Choice of Thread Sizes
9. Unbreakable Gun Body
10. Scientifically Designed Trigger
11. Cartridge Type Air Valve
12. Fluid Connection with a Choice of Thread Sizes

THE DEVILBISS COMPANY · TOLEDO · OHIO

New York *Philadelphia* *Cleveland*
Detroit *Chicago* *St. Louis*
San Francisco *Windsor, Ontario*

Direct sales and service representatives available everywhere

DeVilbiss

A SWEET JOB.. *handled by* ROLLER CHAIN

1800 lb. rolls—20% down grade—30 seconds apart—cars to be returned! Done with a special 6″ pitch Baldwin-Duckworth chain.

This job, developed and installed by the Engineering Products Company, in the "Chicago Tribune" plant, is typical of hundreds of unusual conveying installations that employ Baldwin-Duckworth chain for steady and reliable operation. We can't illustrate them all—even in our catalog—but our engineering department draws on the experience behind them every time a design is developed for a new job — maybe such a job as you are thinking about right now.

BALDWIN-DUCKWORTH CHAIN CORP.
SPRINGFIELD, MASS.
Factories at Worcester and Springfield, Massachusetts

BALDWIN-DUCKWORTH

Not just "another cooler"

Halsey Taylor combination coolers and drinking fountains have for years, been the standard in the industrial world. They have become accepted as the premier coolers with features that promote maximum convenience and economy. Write for latest literature on both ice and electric types, as well as pedestal and wall fountains for industry everywhere.

No. 2800 Ice Cooler

Electric

● Two-stream projector, automatic stream control . . . health-safety because of special Halsey Taylor features. Sturdy, trouble-proof, sanitary!

THE HALSEY W. TAYLOR CO., Warren, Ohio

Two-Stream Projector

HALSEY TAYLOR *Cooler Fountains*

presence of many people breathing out moisture-saturated air, must be carefully considered.

Air conditioning engineers probably have this problem within their control if, when raising the relative humidity, they take care to maintain a positive interior static pressure. In the cigar factory mentioned, the outward flow of warmed air tended to move the dewpoint nearer to the exterior face, and the unusually bad efflorescence on the exterior brickwork is unquestionably due to condensation taking place within the wall, with the subsequent movement of soluble salts in solution toward the exterior face under the influence of static pressure.

Furring is a protection to the plaster itself and by providing an air space tends to shift the temperature gradient. It does not, however, remedy conditions at floor slabs, which must still be directly in contact with the brickwork.

Metal Foil May Help

Metal foil has recently been introduced in a form that makes its consideration economically sound. Since metal films are resistant to the passage of vapor, their proper use on interior walls may be of value in preventing atmospheric moisture in the building from reaching and condensing within the brickwork. The problem of vapor-tight jointing of metal foil is still to be solved. The insulation value is definite and has some effect on the temperature gradient and, therefore, on location of dewpoint line.

Every masonry wall contains soluble salts (most commonly sulphates, chlorides, hydroxides, or carbonates of calcium, magnesium, sodium, or potassium) which are capable of reacting chemically with each other to produce traces of such materials as caustic soda, which will readily saponify paint in the presence of moisture. Or calcium chloride may be formed, which avidly absorbs moisture from the atmosphere. Many of these salts crystallize from solution combined with "water of crystallization," which may be given up or taken on again under varying vapor pressure and temperature conditions.

When distributed in small amounts throughout a wall these salts produce no serious problem; however, after a wall has leaked and these soluble salts have been concentrated locally either in the brickwork or plaster, they may produce the appearance of continued leakage, after waterproofing.

Depending upon the temperature and the vapor pressure of the atmosphere some of these salts may be efflorescent, give up moisture to the atmosphere, or deliquescent, absorb moisture from the atmosphere to the point of dissolving themselves in it. Therefore, moisture may be gathered locally from the atmosphere at temperatures other than the dew-point, and the resulting chemical action frequently produces widespread saponification of paint.

Physical damage to paint and plaster frequently results from crystallization of these salts. Under the proper conditions a crystal tends to assume its own specific shape with a force that can be computed in tons pressure per square inch. Even masonry cannot withstand this pressure and consequently is shattered or spalled. The force exerted when water crystallizes into ice is well known. I have seen extensive spalling occur in brickwork at temperatures above freezing, where the concentration of salts was excessive.

While helping to determine the specifications to be used for the recent rejuvenation of the Washington monument opportunity was given to see the effect of the crystallization of relatively insoluble salts over a long period of time. The marble blocks of this structure are separated by sheets of metallic lead. Oxidation and gradual solution of the metal through the years results in lead salts forming a reddish deposit in the tiny veins of the marble; subsequent solution and recrystallization gradually increase this fissure until the breaking point is reached and the face of the marble spalls. Every piece of spalled marble that I collected showed a deposit on the rear face, and laboratory tests confirmed the presence of lead salts.

In Search of a Cure

How the harmful effect of salts can be prevented after waterproofing treatment is still questionable. Replacement of salt-saturated plaster with new has frequently failed where it was necessary to replaster directly onto the salt-saturated brick. The salts present are capable of creeping through the new plaster, by crystallization under varying vapor pressures and temperatures. Chemical fixation is almost hopeless because several different combinations of the elements are usually present, and the reaction byproduct is also usually a soluble salt.

We are now conducting a series of tests on efflorescent salts and are hopeful that a successful method of control can be worked out. Furring away from the brickwork will remedy conditions except at window, ceiling, and floor junctions, but in many cases this treatment cannot be applied without revision of the entire wall area. Metal foil, too, presents great possibilities from this standpoint.

•

Standard Costs for Profit Control

(Continued from editorial page 216)

•

crease or decrease since the previous month end in process inventories and by adjusting balances shown by an entry between the process inventory account and an inventory adjustment account. It is usual to expect an adjustment of this kind monthly to the extent of about 2 per cent of charges to process accounts. Several times during the year the work-in-process inventory account should be checked by means of a physical inventory.

Operating Statement

The following illustrates the form of income statement that is used, showing how the various cost variations are incorporated.

INCOME STATEMENT

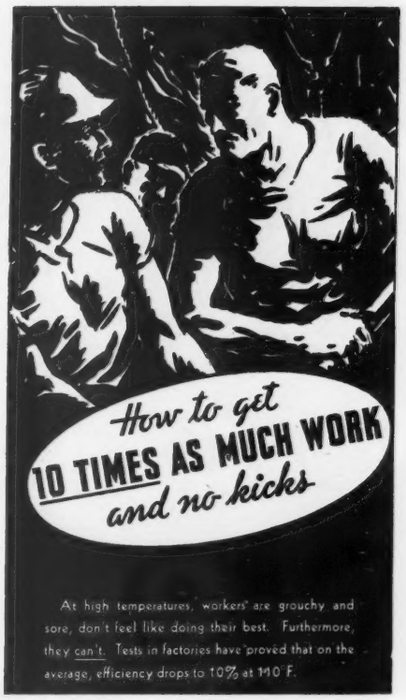
Total Gross Sales		$xx,xxx
Discounts, Replacements, Adjustments, etc.		xx,xxx
Net Sales		$24,000
Cost of Sales		
Standard Cost	$18,000	
Purchase Variations	500	
Volume Variations	1,000	
Manufacturing Efficiency Variations ..	500	
Total Cost of Sales		$20,000
Gross Profit		$ 4,000
Selling, Administrative, etc.		xxx
Net Profit		$

Profit Variations

The foregoing discusses the application of standards to manufacturing costs. Similar principles can be applied successfully to sales volume, selling and administration expenses, turnover, balance sheet ratios, and profit margin. Every factor that governs final net profit can be compared to a standard, and variations from it can be displayed.

Aside from variations in production costs, variations in the following factors will affect net profits:

Sales Volume—Any forecast of profits of necessity requires a fore-


How to get
10 TIMES AS MUCH WORK
and no kicks
At high temperatures, workers are grouchy and sore, don't feel like doing their best. Furthermore, they can't. Tests in factories have proved that on the average, efficiency drops to 10% at 110° F.

At little expense you can restore this costly labor loss, and at the same time make workers feel better and willing to work.

Coppus Heat Killers are the only kind that direct air straight on the job. They're the only kind that can't recirculate stale air. Furthermore, they're lightweight, portable, sturdy, and useful for general ventilation, cooling, drying, driving out foul air, removing dust, smoke, gases, etc.

AEROPLANE
For large volumes (3,700-15,600 C.F.M.) at moderate velocities (2,600-3,850 F.P.M.)

VANO
For moderate volumes (1,500-3,000 C.F.M.) at high velocities (4,300 F.P.M.)

Write for Bulletin 164-2

COPPUS
ENGINEERING CORPORATION

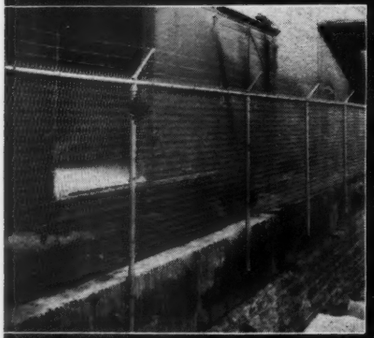
375 PARK AVE., WORCESTER, MASS.
Sales offices and distributors listed in Thomas' Register.

In Sweet's—Steam Turbines, Air Filters, Blowers, Heat Killers.
3322

Steelcrete EXPANDED METAL

Throughout Your Factory you can use Expanded Metal in many convenient and economical forms. Consolidated has so simplified the construction of open-mesh partitions that you can have these needed enclosures "custom-made" to your specifications. Standardized units and accessories simplify the most complicated installation in short order—and construction service is available through an organization of Steelcrete Shops and our new factory.

A handbook covering many uses of Expanded Metal will be mailed to you upon request. Ask also about industrial fence of Expanded Metal.



THE CONSOLIDATED EXPANDED METAL COMPANIES
WHEELING, WEST VIRGINIA
Branch Offices and Warehouses: New York Chicago Cleveland Pittsburgh Philadelphia Boston Buffalo Houston Atlanta
Export Office: 330 West 42nd St., New York, N. Y.

cast of probable sales. This forecast can be broken down into sales quotas which then become standards. When sales fall below quota, variation indicates amount of unrealized potential profits, or conversely.

Selling Prices—Standard profit is based on realization of definite sales prices. Profit variation due to variations from forecasted or standard prices is one of the measures of sales division efficiency that should be developed.

Variety of Goods Sold—Different lines of products frequently have different profit margins, and any changes from the estimated percentage of the various lines in the total volume of sales will result in variation from estimated profits. Amount of this variation can be shown.

Selling and Administration Expenses—Standards should be set up relating expenditure to sales volume, similar to those described for factory burden control, and the effectiveness of the control measured.

Turnover Rates—An important, although seldom recognized, factor in the production of profits is efficient use of capital employed. Excess cash in non-interest bearing accounts and slow-moving inventories represents interest losses and excessive insurance premiums. Slow collections are the equivalent of lending money to customers without interest. Definite standards should be set up covering these items, and losses or gains determined.

Value of Standard Cost Methods

Contrary to general impressions, accounting for standard costing is not complex. In fact, the simpler it is kept, the more effective and economical it will generally prove to be. In the larger organizations refinements can be developed and applied, but usually it will be found that even there all the benefits can be obtained from an installation that is stripped of non-essentials.

One of the most important factors to be borne in mind in any accounting work is that statistics and reports must be drawn up and presented in such a way that other than accountants can interpret them. Management is taking superintendents and foremen more and more into its confidence and explaining to them the progress of the plant through the cost reports. Many of these men have not had the opportunity to study accounting; unless the reports are furnished in a simple and effective way, much, if not all, of their value will be lost.

By the use of standards, accounting records become dynamic and

impelling, and force the operating staff continually in the direction of lower costs and more efficient methods of operation. Once adopted, a standard is simply a measuring stick of an activity. It is a goal of accomplishment. Progress toward the coal is chalked up at frequent periods. Most important of all, the indicated progress is not based on guess, estimate, or judgment, but is definitely tied into the general accounting scheme. The information presented is simple, concise, and easy to understand.

It cannot be emphasized too strongly that the major idea behind this method is not an accounting system but rather control of costs through standards — standards of performance, standards of accomplishment. The whole structure of standard cost methods is built upon the basis of scientifically sound standards covering every activity. That one major idea can be taken and elaborated to suit individual requirements. Accounting *methods* are incidental.

Standards for Everything Else

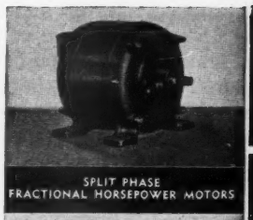
It seems strange that to many people this idea of standards as applied to industry appears so fantastic. This is the more surprising when we consider that our everyday well-being depends almost entirely upon standards. The milk we buy must be up to definite standards of quality. The silver we buy it with has definite standards of value. Examples of this kind could be recited for hours. Why, then, does it seem novel to consider standards of performance for operation of a business?

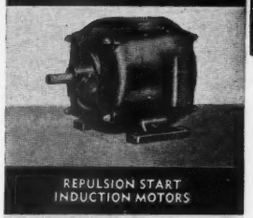
Most manufacturers are careful to make sure that they actually receive quantities and values for which they pay. They check quantities received against invoices. They check extensions and price. If there is an error of a few cents, they make a claim.

They also try to make sure that they receive payment for finished goods that they sell. They check the quantities that are shipped out. They check invoices, prices, and extensions. They set up reserves for bad debts to take care of losses encountered through customers who cannot pay their bills.

But what happens to the materials and values between these two stages of receipt and shipment?

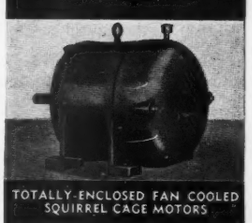
Possibly the raw materials are locked up in storage bins or warehouses. Possibly the finished goods are maintained under lock and key. But what of the materials and labor and various overhead items between


SPLIT PHASE FRACTIONAL HORSEPOWER MOTORS

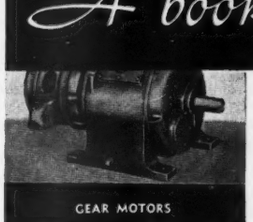

REPULSION START INDUCTION MOTORS

GENERAL PURPOSE SQUIRREL CAGE MOTORS

SLIP RING MOTORS


TOTALLY-ENCLOSED FAN COOLED SQUIRREL CAGE MOTORS

GEAR MOTORS


CLEARANCE TYPE BENCH GRINDERS

Modernize WITH DIEHL MOTORS

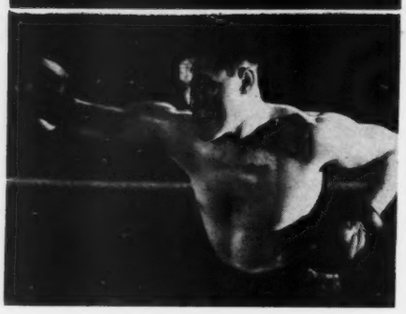
Diehl Motors embody the best principles of modern design and construction and are obtainable in a wide variety of types and sizes for general application or, with mechanical and electrical modifications, to meet individual requirements. Diehl products are held in high regard by satisfied users in every industrial activity, and in the field of transportation by major steamship companies and railroad systems. Our engineers will gladly cooperate in the design, redesign or modernization of your equipment.

A book you can use often

It contains price and catalog data on standard alternating and direct current motors, motor generator sets, electric ventilating equipment, electric grinders and motors for specific applications. Write to our nearest office for your copy.

DIEHL MANUFACTURING CO., Elizabethport, N. J.
Electrical Division of THE SINGER MANUFACTURING CO.
ATLANTA BOSTON CHICAGO DALLAS NEW YORK PHILADELPHIA

He's got a right hook like a **PILE DRIVER**



***But* HE LEADS WITH HIS CHIN**

A REAL CHAMPION HAS NO FLAWS BE SURE YOUR FIRE EXTINGUISHERS HAVE NONE

THE FIRE extinguishers you use must be ready for any emergency —prepared for any kind of blaze. You can't gamble with an extinguisher that puts out one fire and fails on another.

With a fire-killing blizzard of carbon-dioxide snow LUX snuffs out any kind of fire. LUX is as effective on electrical equipment as on the dreaded running-gasoline fire. It is, incidentally, the fastest known extinguishing agent.

LUX extinguishers do no damage. If you were to spray LUX on your desk top it would blanket it in a cloud resembling snow. You would see small white particles dissolve into thin air. You would find your blotter quite dry, everything clean. No mess—and no fumes. And yet LUX extinguishers are deadly to fires—which is what you are interested in.

The complete line of LUX extinguishers ranges from 2 to 100 pounds of capacity. They require no annual recharging.

Write now for your copy of "Instant Death to Any Fire."

LUX SNUFFS OUT FIRE

Walter Kidde & Company
62 West Street Bloomfield, N. J.

the time they are paid for and the receipt of the customer's check which represents the final payment for these items? Here it is that the great preventable losses occur.

Occasionally we find provision for some of these losses made in the costs, but where these allowances have been made we seldom find that the determination of the allowance goes beyond the point of determining what the loss is instead of proceeding to the logical conclusion of determining what the loss should be, and then measuring actual loss against this standard.

Standards properly used mean control. The field for standard setting is practically unlimited, and the profits obtainable from this potential field are vast.

•

TRADE LITERATURE

(Continued from editorial page 240)

veyors and elevators.—Stephens-Adamson Mfg. Co., Aurora, Ill.

Developing Machine—Folder, on "Type 600" Ozalid developing machine for positive prints.—Ozalid Corp., 354 Fourth Ave., New York.

Diesel Engines—Bulletin S-500-B29, on vertical, 4-cycle, direct-injection, Type C engines.—Worthington Pump and Machinery Corp., Harrison, N. J.

Electric Boilers—Specification and price sheet, on Comm-O-Lectric electric-heated steam boilers.—Commonwealth Electric and Mfg. Co., 83 Boston St., Boston.

Fire Pumps — Bulletin W-320-B2, on 2-stage volute, centrifugal fire pumps.—Worthington Pump and Machinery Corp., Harrison, N. J.

Foundry Equipment—Bulletin No. 75, describing line of foundry equipment.—The C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland.

Gears—Catalog, containing data and descriptions of gears and motorized speed reducers.—The Ohio Gear Co., 1333 East 179th St., Cleveland.

Grease Gun—Folder, describing Precision Electric Portable grease gun with one or two grease containers.—Precision Gear and Machine Co., Charlotte, N. C.

Hoist—Bulletin H-1, on "Zip-Lift" hoist. —Harnischfeger Corp., Milwaukee.

Instruments—Booklet, title "Instruments from the Executive Viewpoint"; folder, on instruments and modernization. — The Brown Instrument Co., Wayne and Roberts Aves., Philadelphia.

Instruments—Bulletin 435, on line of recording, controlling, and indicating instruments.—The Bristol Co., Waterbury, Conn.

Instruments and Meters — Catalog on electrical instruments and meters.—G-M Laboratories, Inc., 1731 Belmont Ave., Chicago.

Jack—Bulletin, announcing Clark Lift Jack Unit which functions as lift truck when used with special platform.—All Steel Welded Truck Corp., Rockford, Ill.

Lightning Arresters—Circular No. 385, on Crystal Valve lightning arresters made with glass.—Electric Service Supplies Co., 17th and Cambria Sts., Philadelphia.

Lightning Arresters—Folder, title "Crystal Valve News," on lightning arresters. —Electric Service Supplies Co., 17th and Cambria Sts., Philadelphia.

Lignum-Vitae—Folder, listing properties and uses of lignum-vitae woods.—Lignum-Vitae Products Corp., 96 Boyd Ave., Jersey City, N. J.

Lubricating Oil — Leaflet, announcing Stanoil for industrial lubrication require-

STARTLING!
This Evidence of
PYROIL'S PROTECTION

CORROSION (chemical attack) can ruin bearings and other frictional metal parts of equipment in half their normal life.

PLATE No. 1

PLATE No. 2

Evidence of how Pyroil inhibits corrosion is shown above. PLATE No. 1: A photomicrograph (125 times enlarged) of a bearing run in high grade oil. The dark matter is corrosion. PLATE No. 2: An identical bearing run with only Pyroil added to the oil, showing the remarkable freedom from this chemical attack!

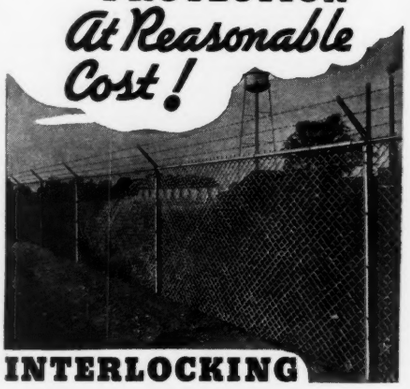
In addition, Pyroil reduces wear and friction; increases film strength of oil.

WRITE FOR FREE METALLURGICAL REPORT AND ADDITIONAL PICTURES

Mfrd. and gtd. by Pyroil Co., W. V. Kidder, founder, 107 LaFollette Ave., LaCrosse, Wis., U.S.A.

Every Container Bears this Signature. Founder

PROPERTY PROTECTION
At Reasonable Cost!



INTERLOCKING
***Chain Link* FENCES**

Here's fencing that gives you what you want—sturdy, dependable protection for years. You have a right to expect years of service from an investment in property protection — and Interlocking Chain-Link fence gives you that.

•

Interlocking Fence is rust-resisting, sturdy and durable. Expert erection service is available. Drop us a line, outlining your problems. We'll be glad to make recommendations and prepare estimates of the cost without obligation to you.

•

Address Desk A Industrial Division

INTERLOCKING FENCE CO.
MORTON, ILLINOIS

AN EYE SAVING SERVICE

. . . *from a Branch Office Near-By*

An American Optical Company industrial representative stationed in a branch office near you — one of the 180 branch offices located in principal industrial centers — is ready to work with you to save workers' eyes and company dollars. He is prepared:

To go over your operations with the executive responsible for safety, help locate the danger spots and determine which of the many types of American Optical Company eye-protection equipment each man needs . . .

To offer a definite program to prevent eye accidents and to sell the plans to foremen and workers . . .

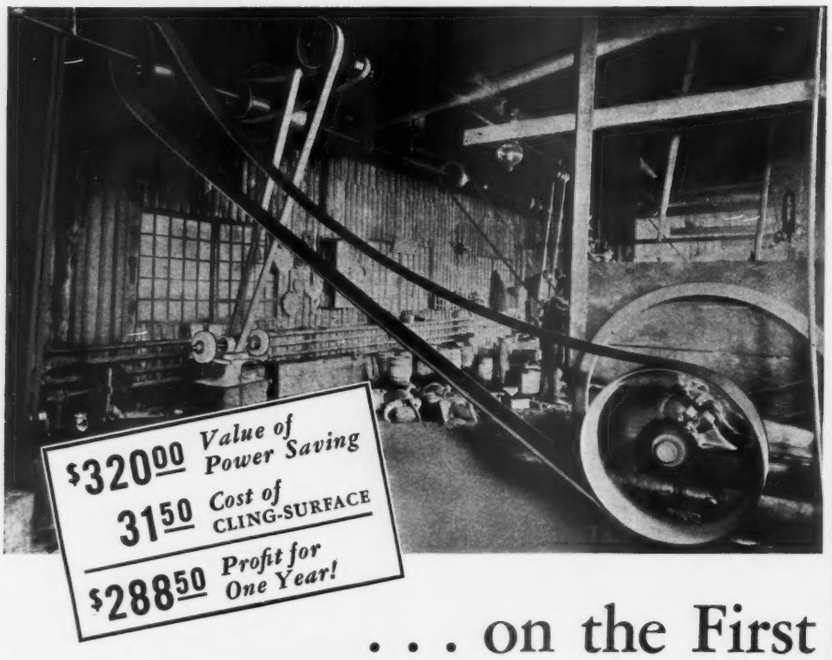
To offer a regular and detailed check-up, safety posters, a personal service that includes every cooperation in *keeping* your eye-safety program efficient and profitable.

Call your American Optical Company branch office . . . have an industrial representative call.

American Optical Company

Manufacturers, for more than 100 years, of products to aid and preserve vision. Factories at Southbridge, Mass. In Canada, Consolidated Optical Co., Ltd. Branch offices in all principal industrial centers

2426



. . . on the First

SLACK-OPERATED BELT

Reliable sources say this was the first drive belt ever *purposely slackened* to increase its transmission of power! An old 12" leather belt, it had stretched out "dead" under years of tension—slipped so much that only part of the machines on its shaft could be run at a time.

Then CLING-SURFACE was used. It restored the belt's elasticity and vigor—gave it better pulley wrap. Slipping was reduced so sharply that the operators experimented with *more* pulley wrap. A piece 18" long was inserted. Now—hanging slack—with all tension relieved, the belt not only drove *all* the machines on its shaft, but several eventually added!

The company was interested—checked costs carefully. In two years, CLING-SURFACE (used in unusually large quantities) cost $63.00—against power savings of $640.00! A total saving of $577.00—or $288.50 annually from one belt!

Why not try CLING-SURFACE in your plant? It stops both slipping and need for tension—delivers full load from slack belts—waterproofs—maintains pliability and lengthens belt life. Thousands of plants use it! Available as liquid in four densities—also convenient bars and tubes. Your mill supply distributor will advise density best for your plant, or write us.

CLING-SURFACE CO., 1058 NIAGARA STREET, BUFFALO, N. Y.

CLING-SURFACE

Preserves power belts—Prevents slipping—Permits slack operation

ments.—Standard Oil Co. (Indiana), 910 South Michigan Ave., Chicago.

Materials Handling—Circular 318, on handling methods and equipment; circular 316 on special equipment for handling barrels, drums, carboys, and cases.—Lewis-Shepard Co., Watertown Station, Boston.

Metal Sprayer—File Folders Nos. 1203 and 1204, on MetaLayeR process and equipment for metal spraying.—Metal Coating Co. of America, 495-497 North Third St., Philadelphia.

Mirrors—Folder, title "Science Finds a way to Make Permanently Brilliant Mirrors." "Evalast" mirrors.—Semon Bache & Co., Greenwich & Morton Sts., New York.

Monel Metal Rod—Folder, with data on monel metal rod.—Whitehead Metal Products Co. of New York, Inc., 304 Hudson St., New York.

Piping—Catalog No. 107, with specifications and prices of Tube-Turns.—Tube-Turns, Inc., 425 Fifth St., Louisville, Ky.

Plating—Folder, describing the Handiplater for small plating jobs.—The Udylite Co., 1651 East Grand Blvd., Detroit.

Portable Elevators—Circular 199, showing portable elevators and stackers.—Lewis-Shepard Co., Watertown Station, Boston.

Power Tools—Catalog list T-4, on Biax tapping attachments for portable power tools.—The Charles L. Jarvis Co., Gildersleeve, Conn.

Pumps—Bulletin 160, on high-speed, non-clogging centrifugal pumps.—Morris Machine Works, Baldwinsville, N. Y.

Pumps—Bulletin No. 2200, on Cameron Motorpumps for air conditioning service.—Ingersoll-Rand Co., 11 Broadway, New York.

Pumps, Centrifugal—Bulletin W-318-B7, on Type UX balanced multi-stage volute centrifugal pumps; bulletin W-323-B3A, on self-priming centrifugal pumping units.—Worthington Pump and Machinery Corp., Harrison, N. J.

Refractories—Bulletin No. 37, title "The Standard Handbook of Refractories."—Standard Fuel Engineering Co., 667 South Post Ave., Detroit.

Resistance Tester—Folder, describing Junior Paragon Constant Pressure Megohmer.—Herman H. Sticht & Co., 27 Park Place, New York.

Rolling Grilles — Catalog, on rolling grilles.—Cornell Iron Works, Inc., 3600 13th St., Long Island City, N. Y.

Steel Furniture — Catalog pages on pressed-steel shop furniture: No. 700 on benches, No. 701 on steel and wood top benches, No. 702 on bench legs, No. 703 on bench drawers, No. 704 on adjustable stools, No. 705 on work stands.—The New Britain Machine Co., New Britain, Conn.

Steel Tubing—Handbook, title "Handbook of Welded Steel Tubing."—Steel and Tubes, Inc., 224 East 131st St., Cleveland.

Surge Protector—Folder 1436, with data on surge protector and arc suppression products.—Sundt Engineering Co., 4238 Lincoln Ave., Chicago.

Switches—Bulletins Nos. 500, 720, 780, 780B, and 780C, on time and magnetic switches.—Zenith Electric Co., Inc., 607 South Dearborn St., Chicago.

Thread Cutting Equipment—Booklet, on performance of thread cutting equipment.—Landis Machine Co., Waynesboro, Pa.

Tool Grinders—Bulletins CG-235, CG-336 and CG-3036, on carbide tool grinders.—Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit.

Trucks—Bulletin, title "Baker Trucks in the Mechanical Industries."—The Baker-Raulang Co., 168 West 25th St., Cleveland.

Trucks and Tractors—Bulletin, on electric trucks and tractors equipped with Exide batteries.—The Electric Storage Battery Co., Allegheny Ave. and 19th St., Philadelphia.

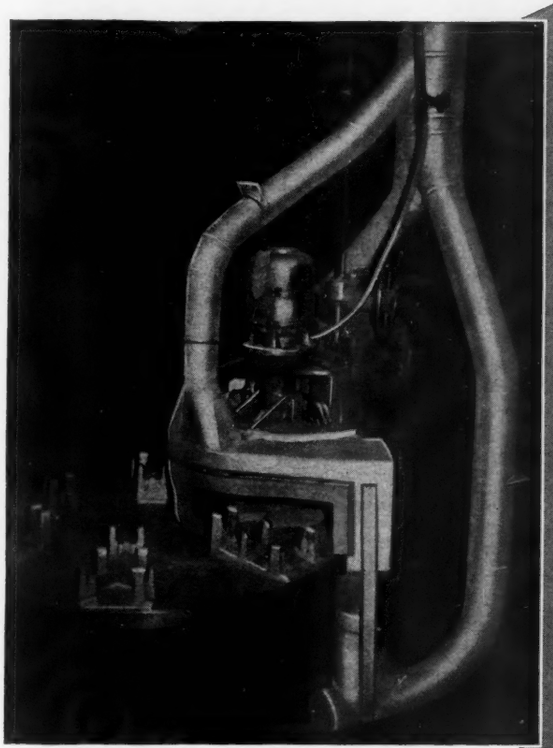
Valves—Bulletin 7000, on forged steel valves for steam lines.—Hancock Valve Division, Bridgeport, Conn.

Valves—Bulletin No. 236, on 2-, 3-, and 4-way hydraulic valves.—W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa.

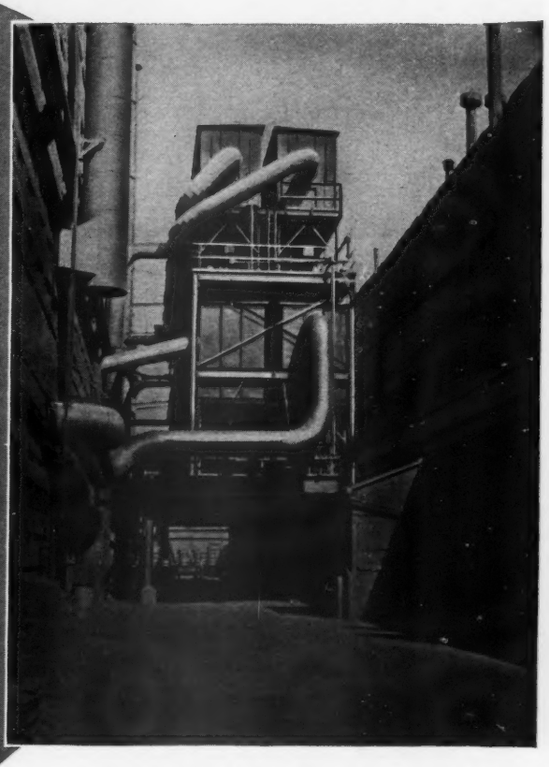
Valves—Catalog No. 11-A-10, title "Valve Material Specifications and Standards."—The Edward Valve & Mfg. Co., Inc., East Chicago, Ind.

DUST CONTROL DETAILS

Proper attention to detail marks the difference between *complete* and partial dust control. The handling of details to a successful conclusion without any false starts is the work of long experience with dust conditions. Blaw-Knox Engineers have such experience and furnish ideas for solution of simple as well as difficult dust problems.



ONE OF THE SMALL DETAILS THAT DISTINGUISHES BLAW-KNOX SERVICE
A typical Blaw-Knox answer to precision in detail is this hood that draws air from above and below the grinder for complete control of a dust nuisance.



A BIG ITEM IN BLAW-KNOX SERVICE
Saving space and locating dust control equipment conveniently is a feature of Blaw-Knox Service. Blaw-Knox Engineers adapt their experience to your business needs.

If your dust problem is large or small—hot or cold—wet or dry—consult Blaw-Knox for prompt and economical solution

BLAW-KNOX COMPANY
2031 FARMERS BANK BUILDING PITTSBURGH, PA.

BLAW-KNOX
DUST CONTROL SYSTEMS FOR INDUSTRY

Weathering the Years..

Throughout 80 years in the design and manufacture of power transmission equipment, WOOD'S have held firmly to the ideals upon which the business was founded, believing that strict adherence to the highest standards of Quality and Service would bring its own reward. At no time have those standards been lowered to meet so-called "price markets"; rather, every effort always has been expended to ***improve*** as advances in engineering science permit.

As a result, WOOD'S Products today, have won an acceptance and preference soundly based upon proven Quality, unvarying and dependable.

WOOD'S PRODUCTS

Shafting, Hangers, Collars, Pulleys, Friction Clutches, Ball Bearings, Flexible Couplings, Rope Sheaves, Pillow Blocks, Belt Contactors, "V" Belts, "V" Belt Sheaves and complete "V" Belt Drives.

T. B. WOOD'S SONS CO.

50 Church St., NewYork City **CHAMBERSBURG, PA.** 387-391 Atlantic Ave., Boston

MEMBER: The Mechanical Power Engineering Associates

Water Coolers—Booklet, Illustrating line of coolers.—General Electric Co., Schenectady, N. Y.

Water Filters—Bulletin no. 401, on porous-stone, boiler feed water filters.—R. P. Adams Co., 220 Delaware Ave., Buffalo.

Welding—Booklet, title "Welding and Cutting High Chromium Steels."—The Linde Air Products Co., 30 East 42d St., New York.

•

BOOKS

BETTER FOREMANSHIP

Glenn Gardiner, executive, Frostmann Woolen Company, and Vice-President, American Management Association. McGraw-Hill Book Co., Inc., 330 W. 42d St., New York. 305 pages and index. $2.50.

Designed to acquaint foremen with the various phases of their new responsibilities and opportunities in today's industrial situation. In three parts, covering: New Features in the Relationship between Foremen and Workers; New Ways of Handling Old Foremanship Functions; and What Every Foreman Should Know About Today's Economic Situation.

INDUSTRIAL AMERICA
Its Way of Work and Thought

Arthur Pound. Little, Brown, and Company, Boston. 234 pages, illustrated. $2.50.

Twelve case studies of large American industrial corporations, each concentrating on a particular phase of the relation of industry to the public—what industry is doing about the scale of living, the security of its workers, the control of wage relations, the standardization of prices.

LIVING-TOGETHER IN A POWER AGE

Samuel S. Wyer. Association Press, 347 Madison Avenue, New York. 227 pages and index. $2.50.

The story of America's development from early individualism to the present complex communal life. Analysis of problems brought about by this latter state. Examination of proposed social systems. A proposed course of action, designed to insure a social order of plenty for all who are willing to work.

•

ON THE CALENDAR

JUNE

15-20, American Society of Mechanical Engineers, semi-annual meeting, Dallas, Texas. Ernest Hartford, Assistant Secretary, 29 West 39th Street, New York.

22-24, American Society of Heating and Ventilating Engineers, semi-annual meeting, Buck Hill Falls, Pa. A. V. Hutchinson, Secretary, 51 Madison Avenue, New York.

22-25, National Association of Cost Accountants, annual convention, Cincinnati. Stuart C. McLeod, Secretary, 1790 Broadway, New York.

28-July 5, Sixth Annual Economics Conference for Engineers, Stevens Camp, Johnsonburg, N. J. James Creese, Vice-President, Stevens Institute of Technology, Hoboken, N. J.

29-July 3, American Society for Testing Materials, annual meeting, Atlantic City. R. E. Hess, Assistant Secretary, 260 S. Broad St., Philadelphia.

AUGUST

19-22, Nineteenth Annual Conference on Industrial Relations, Silver Bay, N. Y. E. C. Worman, Secretary, National Council of Y. M. C. A., 347 Madison Avenue, New York.

31-September 3, Illuminating Engineering Society, annual convention, Buffalo, N. Y. A. D. Cameron, General Secretary, 29 West 39th Street, New York.

31-September 4, National Association of Power Engineers, Power Show, Chicago. F. W. Raven, Secretary, 176 West Adams Street, Chicago.